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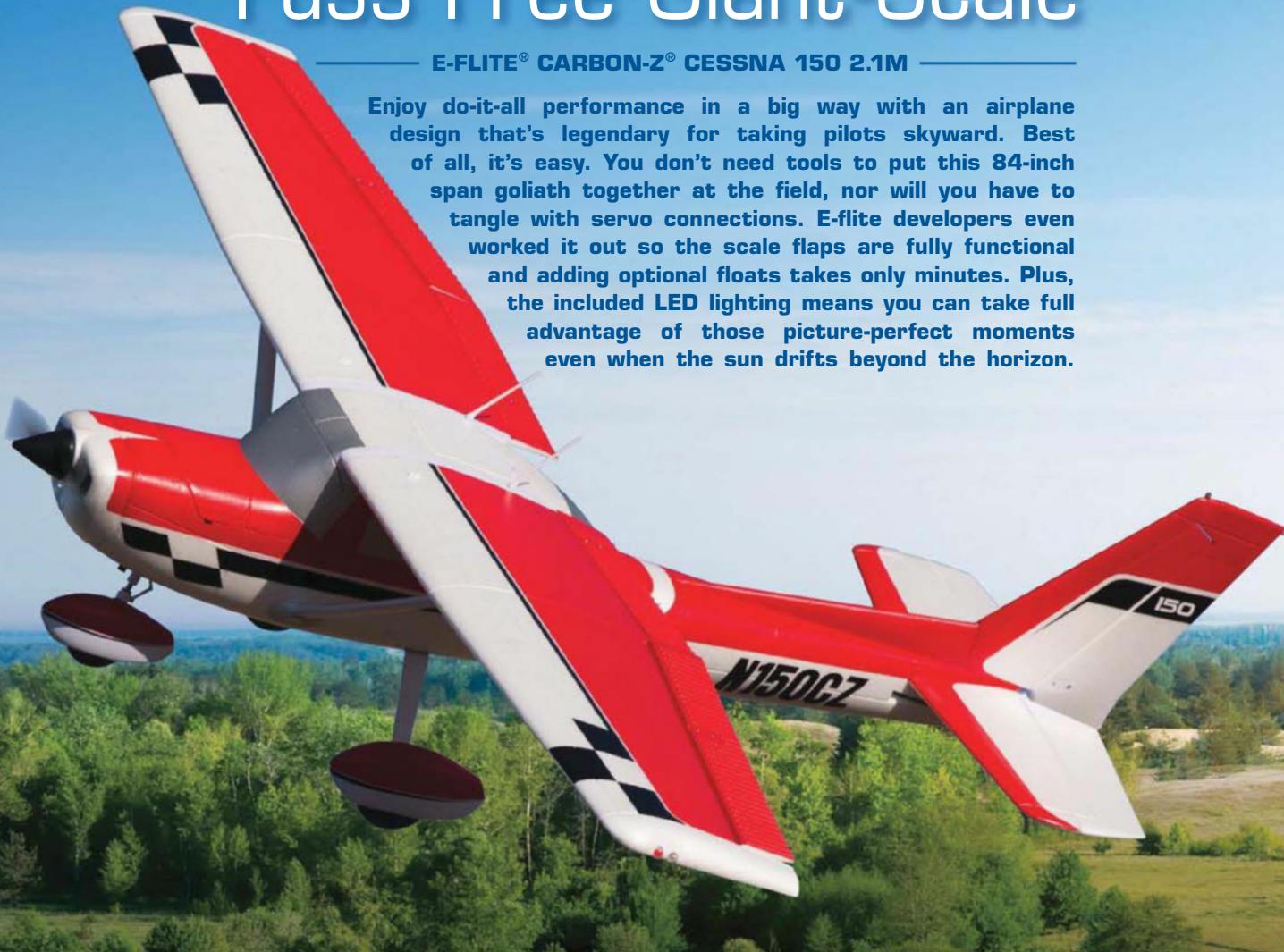
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Please go to next page.

Fuss Free Giant-Scale

E-FLITE® CARBON-Z® CESSNA 150 2.1M

Enjoy do-it-all performance in a big way with an airplane design that's legendary for taking pilots skyward. Best of all, it's easy. You don't need tools to put this 84-inch span goliath together at the field, nor will you have to tangle with servo connections. E-flite developers even worked it out so the scale flaps are fully functional and adding optional floats takes only minutes. Plus, the included LED lighting means you can take full advantage of those picture-perfect moments even when the sun drifts beyond the horizon.



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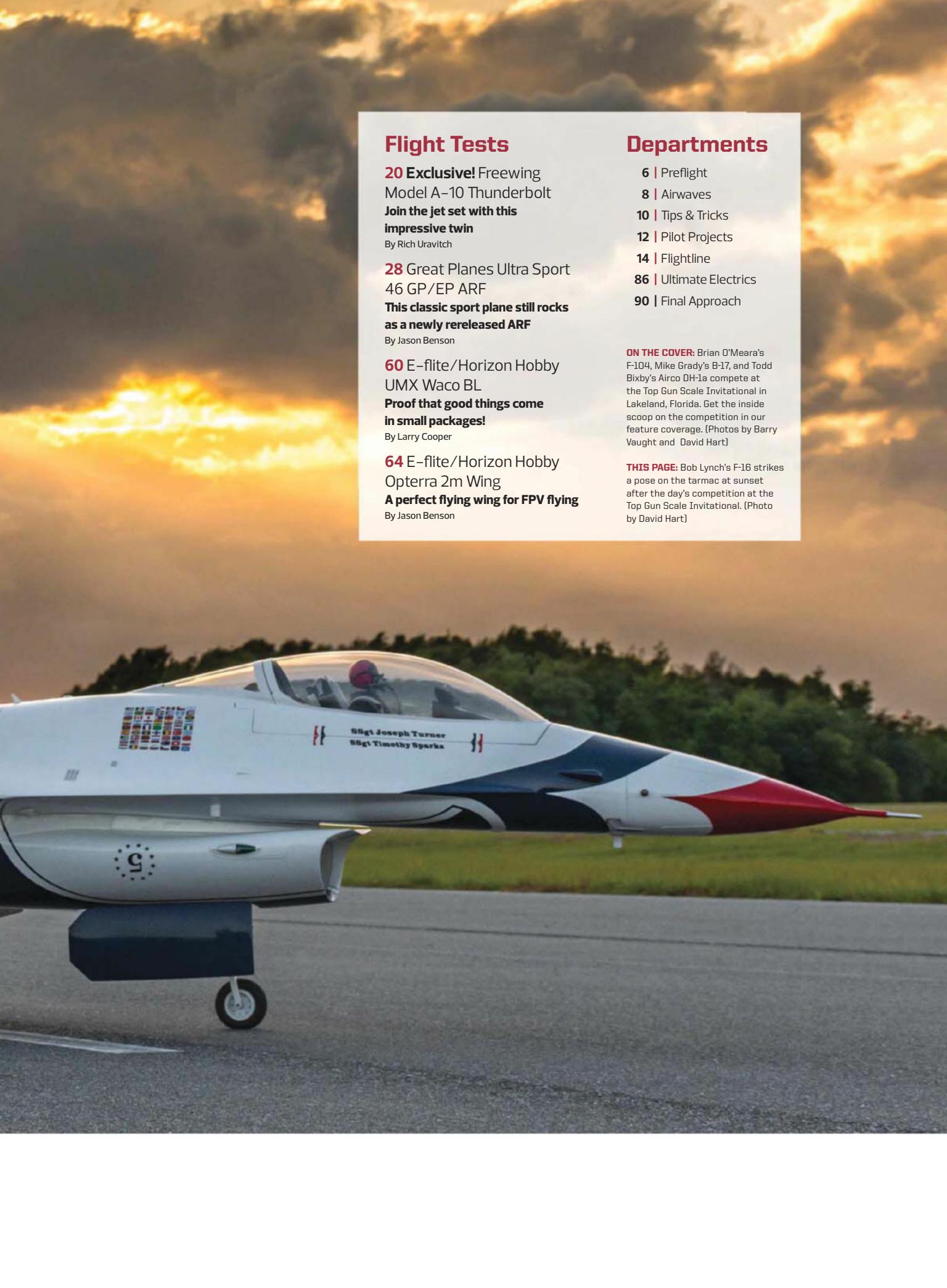
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ON THE COVER: Brian O'Meara's F-104, Mike Grady's B-17, and Todd Bixby's Airco DH-1a compete at the Top Gun Scale Invitational in Lakeland, Florida. Get the inside scoop on the competition in our feature coverage. (Photos by Barry Vaught and David Hart)

THIS PAGE: Bob Lynch's F-16 strikes a pose on the tarmac at sunset after the day's competition at the Top Gun Scale Invitational. (Photo by David Hart)

Preflight

BY DEBRA CLEGHORN | EXECUTIVE EDITOR



Jose Melendez's Hawker Hunter placed first in Sportsman class at this year's Top Gun Scale Invitational. (Photo by Barry Vaught)

Scale Excellence

For the past few months, we've been following the road to Top Gun, the scale invitational founded 29 years ago by event promoter Frank Tiano. You might think that an annual event that has been taking place for nearly three decades would have a lot of familiar faces, and you'd be right: Top Gun is a much-anticipated reunion of master craftsmen and pilots who have become a scale RC family. But it's also a place where newcomers are welcome, and this year's competition had a bumper crop of 34 pilots who had never before attended the event.

In this month's coverage, we take an inside look at the planes and pilots of Top Gun, from the event winners to special awards and the minute details that set these scale machines apart. Next year's competition will take place May 1–6 at Paradise Field in Lakeland, Florida, so mark your calendars now! This event is definitely one to add to your bucket list. We hope that you enjoy our Top Gun feature and that you'll set your flight path to ModelAirplaneNews.com/road17 for more stories and photos from this celebration of scale excellence.

In This Issue

In his book *2-Stroke Glow Engines*, glow-power guru David Gierke wrote, "An engine's first few runs determine its destiny—to be a great runner or mediocre. To ensure the best possible outcome, an engine's metal components must be mated under *light* dynamic and thermal (temperature) loads." That's exactly why, this month, we asked our senior technical editor Gerry Yarrish to share his time-tested techniques for breaking in a two-stroke glow engine. With a proper break-in and subsequent care and feeding, a glow engine can last for decades—some of the first model-airplane engines of the 1930s are still running today!

Everyone who uses LiPo batteries—even if they only power your airborne radio system—

should read John Kauk's *Ultimate Electrics* column this issue because he talks about the proper disposal of these batteries. I know you've seen photos of what a damaged LiPo battery can do, so why would you toss old batteries in the trash? It's easy to deplete their stored energy and dispose of them responsibly and properly, as you'll see in John's column.

If you haven't experienced the thrill of using your RC-powered plane to tow an RC sailplane to altitude, then you won't want to miss this month's feature on aerotowing. This RC team sport is a terrific way for pilots of sailplanes and powered planes to work together, and Andrew Griffith's article, "Intro to Aerotowing," details everything you need to know to get started. Try this fun way to get airborne and you may not want to stop!

MODEL AIRPLANE NEWS
Est. 1929

EDITORIAL

Executive Editor Debra Cleghorn debrac@airage.com

Senior Technical Editor

Gerry Yarrish gerry@airage.com

West Coast Senior Editor John Reid johnr@airage.com

Associate Editor Matt Boyd matth@airage.com

Copy Editor Suzanne Noel

CONTRIBUTORS

Jason Benson, Sal Calvagna, Budd Davisson, Don Edberg, Mike Gantt, Dave Garwood, Dave Gierke, Greg Gimlick, John Glezelis, Aaron Ham, Carl Layden, Clarence Lee, Jim Newman, Greg Poppel, Mark Rittinger, Jim Ryan, David Scott, Jerry Smith, Craig Trachten, Paul Tradelius, Pat Tritle, Rich Uravitch, Michael York, Nick Ziroli Sr.

ART

Creative Director Betty K. Nero

Art Director Kevin Monahan

DIGITAL MEDIA

Web Producer Holly Hansen

VIDEO/PHOTOGRAPHY

Photographer Peter Hall

Videographer Adam Lebenstein

ADVERTISING

Strategic Account Manager Mitch Brian
203.529.4609 | mitchb@airage.com

Interactive Account Executive Joe Corrado
203.529.4636 | joec@airage.com

Interactive Account Executive Jane Tacca
203.529.4628 | janet@airage.com

CONSUMER MARKETING/PRODUCTION

The Media Source, a division of TEN,
The Enthusiast Network

MARKETING & EVENTS

Marketing Assistant Erica Driver
Event Manager Emil DeFrancesco

PUBLISHING

Group Publishers Louis V. DeFrancesco Jr.,
Yvonne M. DeFrancesco



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Comments may be sent to: MAN@airage.com



EDITORIAL OFFICE

88 Danbury Road, 2B, Wilton, CT 06897 USA

EMAIL MAN@airage.com



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We love hearing from our readers: Your emails, tweets, and comments quickly let us know what you'd like to see more (or less!) of in upcoming issues and online. Here's what some of you are saying about *Model Airplane News* magazine.

Facebook FAA Federal Registration Rule Struck Down!



Recently, we posted a Newsflash regarding a federal appeals court that struck down the federal rule that required RC modelers to register their devices with the Federal Aviation Administration (FAA). The U.S. Court of Appeals for the D.C. Circuit ruled that federal law prohibits the Federal Aviation Administration from issuing any rules or regulations covering "model aircraft." It's a big win for model-aircraft enthusiasts as the registration requirement was too burdensome. The three-judge panel agreed that safety is an important goal but said it's up to Congress to change the law. Here's what you had to say.



CR: *The special consideration for sUAVs [small unmanned aerial vehicles] concerned all RC-controlled aircraft, not just drones.*



SP: *The FAA should be forced to return the millions of dollars they stole from the American people when they illegally forced us to pay \$5 for registration.*



JJ: *Fliers where I live are flying both drones and planes at the same field with no problems.*



JD: *Good. I've held out in playing their game. RC planes aren't the problem.*



GB: *This might be/could be/maybe a misdecision on their part. Not being an RC owner nor a drone operator, this is all I will say. Time will tell.*



RB: *Sure glad I never did put that very long number on my aircraft.*



AC: *I always wondered how registration was an assurance that someone would be safe and ethical.*



ModelAirplaneNews.com Aussie Spitfire

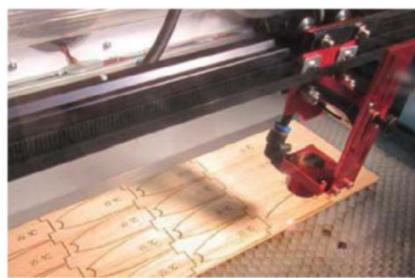
We recently posted a video on ModelAirplaneNews.com that grabbed a lot of attention. This giant 1/4-scale Supermarine Spitfire is a Mk VIII and carries the Australian marking for the "Grey Nurse," which is based at the Temora Aviation Museum in New South Wales in Australia. Malcolm Harle built the World War II fighter from a Flying Legends kit designed by Mike Booth, and Malcolm powered the 110-inch-span Spitfire with a DA 85cc gas engine turning a 26x10 prop. Thanks to Pete and Dean Coxon who videotaped Malcolm flying in 15mph winds—with a crosswind!—at the Greenacres meet in Walsall, England.

Steve Carper: *Wow, sweet plane—and flight!*

Hans Kleynhans: *A beautiful model and very well-made video of its magnificent flight.*

K. Plumley: *Very nice plane and a great video. The engine, however, sounds horrible, like a mad hornet; terrible choice of a muffler.*

Vic Minetola: *Wow! Nice airplane. Looks great in the air—unmistakable silhouette. Fine aerobatics and realistic ground handling.*



Well, Carl, you are both correct. First, accurate laser-cut parts, those that will fit together correctly, depend on the accuracy of the plans/drawings. So, yes, original CAD (computer-aided design) files will produce excellent laser-cut parts if formatted correctly and drawn precisely. But there are some laser-cutter companies that will scan your paper plans and produce parts from them. Again it depends on the quality of the human-drawn pencil drawings. One such company is lasercutusa.com. The owner, Patrick Fallacara, scans his customer's plans into his computer using the CorelDraw PLT format as well as AutoCAD, DWG, and DXF file formats, which his laser-cutting machine can work with. He then will check the new "cut files" for basic line quality, and he even returns the paper plans undamaged. But here again, the parts produced will be only as good as the paper plan's quality. Hope this helps.—GY

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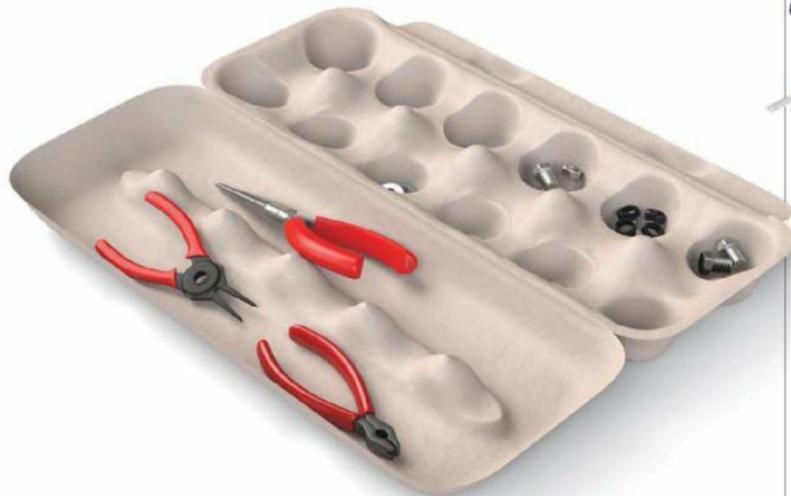
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Tips & Tricks

USEFUL HINTS FROM MODELERS | Illustrations by Richard Thompson



INEXPENSIVE ORGANIZER

By keeping hardware and fasteners organized while you work **on your airplane**, you can speed the process as well as prevent needed items from rolling off your workbench. Also, keeping everything neat and tidy greatly lowers the chances of placing your model on something hard, causing hangar rash. The handy dandy egg carton does the trick, and it costs nothing (after all the eggs have been scrambled). It's also a great way to recycle an item that usually finds its way to the landfill.

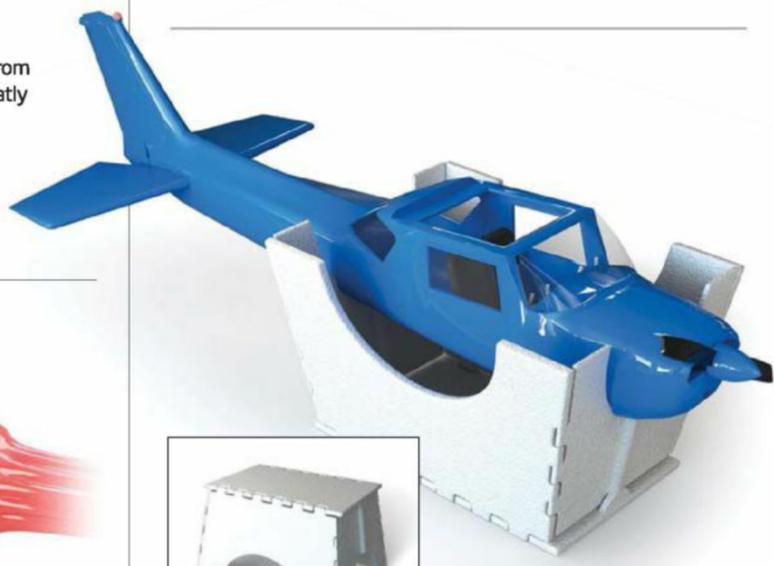
Danny Carozza, Yonkers, NY



HANDY WING TOTE BAGS

Pick up a laundry bag at the local home-goods store and you have a ready-made wing bag. Available in cloth and nylon, they come with drawstring pull ties. Turn them inside out and sew a seam along one edge to make a custom bag. You can use it to store extras like wing tubes and struts all in one place, and it offers just enough protection for storage and transportation—and it's machine washable!

Dave Cook, North Ridgeville, OH



MULTIPURPOSE STOOL

Made out of easy-to-clean plastic, a foldable step stool is available at most DIY stores. It comes in handy, as designed, to sit or stand on in the workshop. But if you flip one over at the flying field, it can do double-duty as a sturdy airplane stand to keep your model off the ground while assembling and working on it. Folded up, a step stool takes up almost no space in the trunk of a car. Bolting on a wing has never been easier.

Tony Kollaja, Hayden, ID

QUICKIE SPARE HAND

When you are trying to solder some wires together, you often need more than two hands to get the job done. A convenient way to get around this is to use a spray-paint cap and cut two slits into the sides; place the wires in the slits and the cap will hold them in place. That way, you can handle the soldering iron while feeding the solder into the joint—a quick-and-easy solution!

Aaron Ham, Sherman, CT

SEND IN YOUR IDEAS! We want your ideas for Tips & Tricks! This month's winners will receive a *Model Airplane News* baseball cap. Send a photo or rough sketch and a brief description to MAN@airage.com or *Model Airplane News*, c/o Air Age Media, 88 Danbury Rd., Wilton, CT 06897 USA.



Pilot Projects

SHOWCASING WHAT YOU BUILD & FLY | Email entries to: MAN@airage.com



BD-5J

Guy Motovich, Rehovot, Israel

Built from Skymaster's X-Treme Jets kit, this model is powered by a Wren Supersport turbine with 8.2kg of thrust. The 86.6-inch-span jet is controlled by a Futaba 12FG transmitter and sports the James Bond "007" logo on its tail and nose along with Israeli flags on its sides. Guy thanks his friend Ofir Babisch for his support and help, and writes, "It has excellent flight performance and is very stable when landing with flaps."



Indoor Gee Bees

Richmond Hill Model Airplane Club, Richmond Hill, ON, Canada

Club treasurer Lawrence Cotton writes that these indoor fliers, designed by two club members, have become a favorite project. Made out of 3mm, 5mm, and 1.5mm Depron, each 2-ounce plane is powered by a HK 18-11 motor and a single-cell 300mAh battery. Lawrence adds, "When they're all airborne together, this gaggle of Gee Bees is a sight to see!"

1930s' Condor

John Taye, Boise, ID

Built from the BMJR Models kit, this 2-meter-span, 2-channel model is covered with transparent MonoKote and weighs about 10 ounces. John notes, "Originally, it was a towline glider and now can be launched with a gentle high-start."



Piper Cherokee Archer

Darren M. Gibson, Eau Claire, WI

Built from the .40-size Great Planes kit and modified to become the Cherokee Archer variant, this aircraft is powered by a Super Tigre .51 engine turning a 10x7 prop. A Futaba 7C radio provides guidance.

SEND IN YOUR PICTURES!

Model Airplane News is your magazine, and we encourage reader participation. Email your high-resolution images to MAN@airage.com, with your contact information and details on your project. Every pilot we feature will receive a *Model Airplane News* baseball cap, and the "Pilot Project of the Month" winner will receive a *Model Airplane News* "swag pack."

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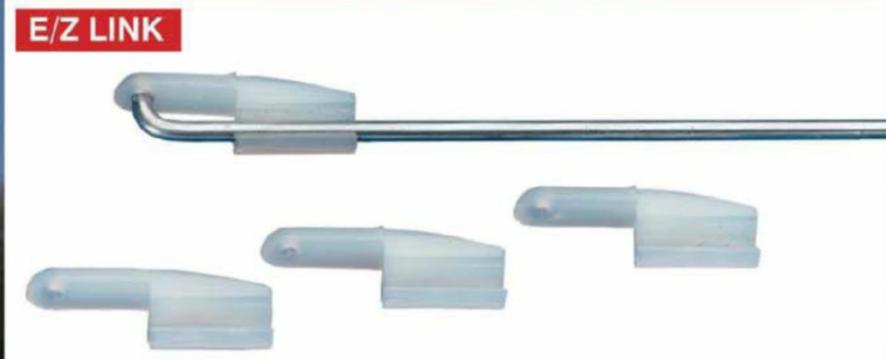
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Multiplex Extra 330SC

Designed by world champion pilot Gernot Bruckmann, this Extra 330SC is a smaller version of his impressive, award-winning aerobat. It features a carbon-fiber-reinforced foam airframe, allowing you to perform the most dramatic 3D maneuvers like a pro, and its detachable fin and tailplane make transporting it convenient and simple. Available in two schemes, the orange kit costs \$199.99, and the blue receiver-ready model is \$379.99. hitecrcd.com

Blade Inductrix FPV Pro

This next-level micro FPV racing drone is fast, light, durable, and ready to help you win! The Inductrix Pro has a new reinforced-frame design that can easily handle the inevitable hard landing, and its improved 25mW camera with VTX has a monopole antenna for performance and durability. The Inductrix Pro comes with a Betaflight-configurable controller and is ready to bind to your DSMX/DSM2 transmitter and FPV headset. It costs \$119.99. bladehelis.com



Blade Theory XL 5-inch BNF Basic

This FPV racer's "stretched-X" design offers impressive stability in fast-forward flight, and its 4mm frame thickness stands up well to crashes. Four 2206-2450Kv thrust motors swing 5-inch propellers, and 30-amp speed controls make every maneuver feel locked in. An F3 flight controller comes preflashed with Betaflight firmware and is configurable to any flight style, and an included 200mW transmitter with power switch and 700TVL CMOS camera provide clean, reliable video in any environment. You'll need a 4S 1000-1550mAh battery for this race-ready machine. This BNF Basic racer is \$379.99. bladehelis.com



Tactic TTX660

Whether you fly planes, helicopters, or drones (or all three!), this 6-channel radio has you covered. It features user-friendly programming, 30-model memory, and two sliding levers and a proportional dial that are ideal for controlling flaps or an FPV camera. Its large graphing LCD screen has adjustable contrast and blue backlighting for easy viewing. The TTX660 costs \$139.99. tacticrc.com

Xuron Drone Tool Kit

Ideal for field wiring repairs, this kit includes the Model 2175 Maxi-Shear Flush Cutter, for soft wire and materials up to 12 AWG; the Model 2193 Hard Wire Cutter, for hard wire up to 1mm diameter; and the Model 501 Adjustable Wire Stripper, with a thumb-adjustable cam that can accommodate wires from 10 to 26 AWG. Packed in a handy canvas pouch, all the tools are made out of high-carbon steel and are blackened to prevent glare; they have cushioned rubber hand grips and a Light-Touch return spring. The Drone Tool Kit costs \$55.40. xuron.com



Phoenix Model 1/7 P-51 Mustang

This 55.5-inch-span warbird features built-up construction and comes with retracts, a pilot figure, a fiberglass cowl, and a spinner. Its removable top hatch makes it easy to change batteries. Add a .46-.55 two-stroke, .52 four-stroke, or RimFire 55 brushless motor or similar powerplant in its nose and install your 6-channel radio system and this warbird will turn heads at any flightline. It costs \$199.99. towerhobbies.com



Icare-Icarus Lunak LF-107

This 1/4-scale version of the '50s Czech glider has flaps as well as a prefit, fixed wheel and a painted canopy tray. It features a seamless painted epoxy fuselage and plug-in, obechi-sheeted foam wings that are reinforced with carbon fiber. The Lunak is equipped with factory-installed, double-stage airbrakes. The 141-inch- (3.7m-) span Lunak costs \$1,069.00. icare-icarus.com



Futaba 6L Sport

This new 6-channel, 2.4GHz radio system comes with an R3106GF high-voltage receiver with fail-safe and is equipped with V-tail, elevon, and flaperon mixing and servo reversing. It also has a two-position switch and rotary dial and a low-battery alarm. Learning to fly? The 6L has a buddy-box trainer port that's ideal for new pilots. The Futaba 6L Sport costs just \$89.99. futabarc.com

Phoenix Model Westland Lysander 1:4/75

Designed for a .46-.55 two-stroke, .52 four-stroke, or RimFire 65 brushless motor, this 126-inch-span beauty features balsa-and-ply construction and heat-shrink covering. Equipped with scale flaps, this ARF comes with a painted fiberglass cowl, and fiberglass wheel pants and landing gear covers complement the prebent aluminum landing gear. A removable hatch allows easy access to the batteries and radio gear, and a two-piece wing makes transport easier. The giant Lysander costs \$599.99. towerhobbies.com



Hacker Edge 540-V3

Made out of light, nearly unbreakable, carbon-reinforced EPP foam, the Edge 540-V3 has the strength and precision needed for experienced pilots to perform loops, knife edges, and unlimited maneuvers. It requires a 1200Kv brushless power system and 4-channel radio with three micro servos. The 39.3-inch-span racer costs \$71.99. towerhobbies.com



Tower Hobbies

Ryan STA EP ARF

This model of the Golden Age icon features built-up construction and fiberglass cowl, wheel pants, and fairings. It's ideal for pilots who are ready to step up to a scale aircraft. It has a removable, one-piece wing and short, direct servo linkages for superior control. The 53-inch-span ARF requires an 800Kv brushless power system and a 4-channel radio with four mini servos. It costs \$139.99. towerhobbies.com



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Flightline

Hangar 9 Van's RV-4 30cc

With scale details like landing lights, realistic hinges, functional flaps, a cockpit, and a pilot figure, this model of the famous home-built design is sure to turn heads at the field. The 85-inch-span model is intended for a 30cc two-stroke, 57-61cc four-stroke, or electric equivalent and comes with a painted fiberglass cowl and wheel pants and aluminum landing gear with painted fairings. This 30cc ARF features built-up construction and a two-piece plug-in wing and horizontal stabilizer. It costs \$449.99. hangar-9.com



Tower Hobbies Uproar V2

Powered by a .46 two-stroke or an 800Kv electric motor, this fun-fly aerobat offers incredible performance. Its wingtip plates provide stability for awesome high-alpha and 3D flight. A symmetrical airfoil makes loops, rolls, and inverted flight a breeze. White Oracover film allows you to create custom trim schemes. This 47.6-inch-span ARF costs \$99.99. towerhobbies.com

MaxAmps FPV Race Edition LiHV+ Pack

This 1600HV+ 4S high-voltage pack will take your high-demand FPV racer to the next level of power and performance. Engineered to hold a higher voltage under load, it also has 1mm-thick battery plates installed on the top and bottom of the battery pack for added protection from crash damage. It costs \$69.99. maxamps.com



RBC Kits F9F-6 Cougar

Building board empty? Check out this 90mm EDF kit that features CNC-cut ribs and formers and a tab-lock design, which speeds assembly. A vacuum-formed canopy, fairings, and nose cone are included. The 4-channel jet is intended to use a HET RC EDF 600 series motor, 70-amp speed control, and WeMoTec Midi fan or similar. The kit costs \$185.00. rbckits.com



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EXCLUSIVE

Freewing Model A-10 Thunderbolt

Join the jet set with this impressive twin

TEXT & PHOTOS BY RICH URAVITCH



The A-10 Thunderbolt II, better known as the "Warthog" or simply "Hog," is one of those unique military airplanes that nobody really got excited about when word of its development got out about 1975. Nobody (except those guys on the ground known as Army "grunts") realized that someone was giving them a means of getting help when they were pinned down under real crummy conditions.



The size of the completed model is evident here. The two items in the foreground are actual A-10/GAU-8a 30mm cannon rounds.



AT A GLANCE

MODEL	A-10 Thunderbolt II
MANUFACTURER	Freewing Model
DISTRIBUTOR	Motion RC (motionrc.com)
WINGSPAN	66.9 in.
PILOT SKILL LEVEL	Intermediate
ASSEMBLY TIME	2 hours
RADIO REQ'D	6-channel
POWER REQ'D	Two 6S 5000mAh LiPos
PRICE	\$599.00

WHAT WE LIKE

- ✚ Accurate scale appearance
- ✚ Highly prefabricated, excellent fitting parts with structural reinforcement as required
- ✚ All wiring preinstalled, including connector boards
- ✚ Functional NAV, position, strobe, and landing lights
- ✚ Full complement of external weapons and pylon included

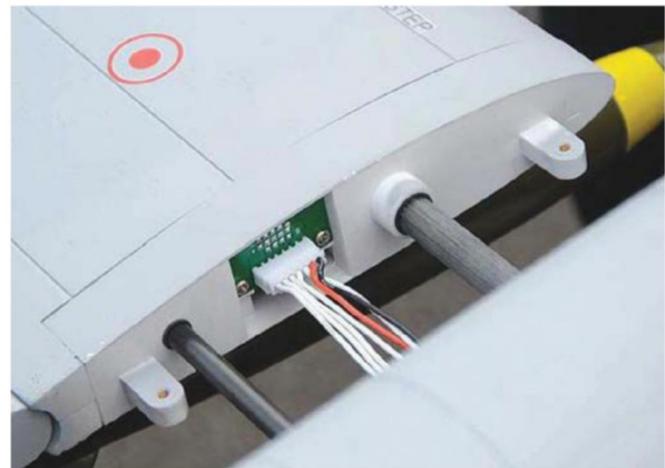


THIS MODEL IS THE RIGHT SIZE, IMPRESSIVE, AND ENJOYABLE TO FLY. I WOULD GET IN LINE TO BUY ANOTHER SHOULD ANYTHING EVER HAPPEN TO IT.

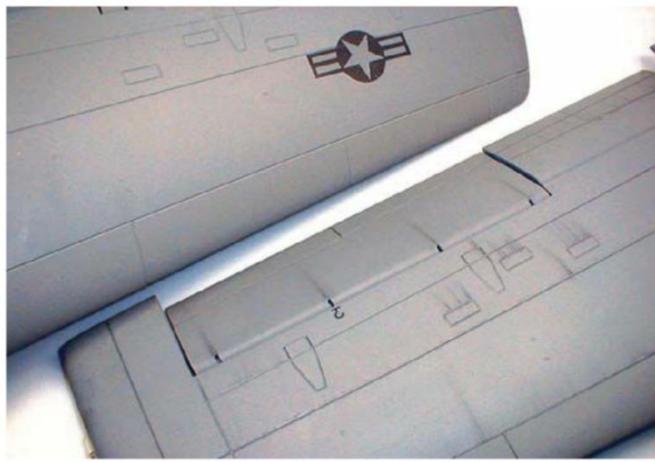




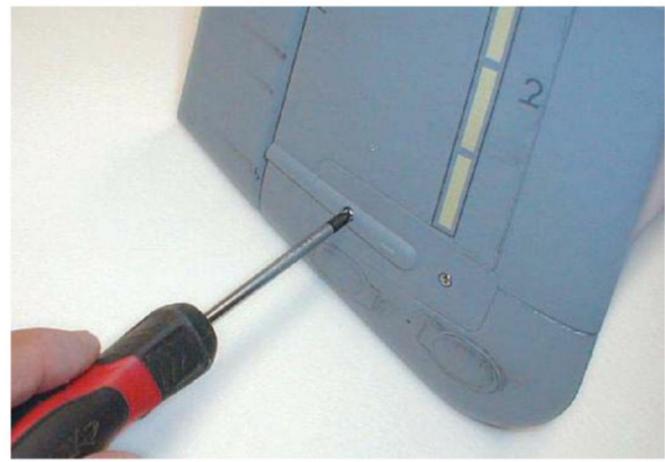
The internal structure of the molded wing panels consists of accurately fit wood, carbon, and aluminum components for strength.



Electrical connectors at the wing splice joints enable power to the aileron and flap servos. They also simplify disassembly.



I applied touches of charcoal along panel edges and surfaces to simulate in-service "streaking" to add visual definition.



The vertical fins, like many of the airframe components, are attached with screws—more assembling than building!

CAS (close air support) was an Air Force acronym that sounded cool, but unfortunately, nothing in the inventory could really do the job effectively. Sure, nearly everything in the theater was tried; fast movers like the Huns, Thuds, Scooters, and Rhinos got the job done

when needed but not nearly as effectively as slower platforms like the '50s-era A-1 Skyraiders ("Sandys"), which had better fuel economy, had longer loiter time, and were less vulnerable to the ever-present small-arms fire from the ground. Couple that with the looming mechanized artillery threat in Europe and the requirement was confirmed: We needed a new airplane.

The subject of this review is a nearly 6-foot-span electric A-10 model jointly developed by Freewing and Motion RC. Their models are gaining a great reputation in the RC arena, and their line of molded EPO foam models, including a wide variety of electric jets, just keeps expanding as new subjects are released. This model is a whole new breed of molded-foam electric scale jet. The model comes carefully packaged in an enormous box and is broken down, requiring assembly time of about two hours using a package of screws and a small tube of adhesive. The "kit" is quite complete; you'll only need to add a receiver and propulsion batteries. The manufacturer makes no specific recommendation as to the experience level

required; that's not unusual because many of today's newcomers advance rapidly for a variety of reasons. Using generally accepted definitions, I would suggest that fliers be at the intermediate level for this model.

UNIQUE FEATURES

The quality of all the molded EPO foam parts is among the nicest I've seen as is the fit of all components, even those hidden from view on the inside of the model. Speaking of inside, you might wonder, as I did, how this molded-foam machine, fitted with retracts in the foam wings and noted for tight turning, high-G maneuvering, withstands those kind of loads. Well, it isn't magic, my friends—just good design. There are actual wood, carbon-fiber, and aluminum components molded into the wing to provide span-wise stiffness to prevent the wingtips from touching each other during those brisk pull-offs from the imaginary tank column you've just strafed. This model is not just designed—it's engineered! Couple that feature up to the two carbon-fiber tube wing joiners and I don't think you have any risk of having this wing fail!

GEAR USED



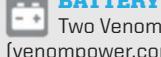
RADIO
Spektrum DX8 w/ AR7000 receiver and one satellite (spektrumrc.com)



MOTOR
Two 3530 1900Kv brushless outrunners w/ two 100A speed controls w/ 8A UBEC (installed)



PROP
9-blade fan rotors (installed w/ fan units)



BATTERY
Two Venom 6S 5000mAh 50C (venompower.com)

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The 80mm fan unit is premounted in front of the speed control, which is cooled by air through the nacelle.



There's a nice transition of the molded-foam nacelle inlet to the fan shroud to smooth airflow to the fan face.

All control surfaces are prehinged, and all that you'll need to connect during the "build" are the ball-linked pushrods, which are also set up for you. Each of the four flap assemblies gets its own servo to drive it, and the three-unit retract system is preinstalled and wired. One of the features I really appreciated was that all the wiring to the servos, retracts, lights, and anything else was also preinstalled as harnesses that terminate at a single modular connector where the wing panels join the fuselage. No separate flap, retract, and aileron extensions or Y-harnesses on this baby—just one neat connection and two screws on each wing panel and you are ready to roll. I love it!

The nacelle package that houses the 80mm EDF units is complete, modular, and easy to install after joining the two fuselage sections using supplied adhesive and a carbon-fiber tube. The only tricky part here is snaking all that wiring located in the aft fuselage through the forward section, where a preinstalled "connector board" is located. Freewing even helps you out here by providing a looped wire so that you can snake the wire through successfully.



A complete weapons/external stores package is provided in the kit (gunburst courtesy of PhotoShop!).

I assembled my A-10 strictly by the book—in this case, the user manual that is presented conveniently in English and Mandarin. Two sheets of decals are provided, along with a placement guide, to replicate one of three A-10s. One of these sheets is of the thin-film, self-adhesive variety, which is not at all like the traditional glossy film with color applied that you need to closely trim to the inked edge before applying to your model. These are pretrimmed, with no clear edges on a high-gloss carrier sheet. You simply remove the backing, place the marking precisely in the exact position you want (which is easy to see because you're looking through the completely transparent carrier), press it into place, and remove the transparent carrier sheet. No excessive clear edges! Any marking that might need to follow a contour, like the nose markings on this model, is provided as a traditional water-transfer type of material, which easily negotiates and sticks well to sharp curves.

IN THE AIR

The first flights of my A-10 were from our group's flying site, which has hard surfaces

with grass aprons and overruns, but I have no doubt that the model would be quite comfortable on closely cut grass. The trailing-link gear struts, cleverly designed to have a scalelike, straight appearance of the full size, would easily handle slightly bumpy terrain. The tricycle-gear arrangement makes ground handling a nonissue, and steering/tracking is very accurate. After takeoff, the model required only minor trim adjustment, with the throws set as recommended in the manual. To land, enter downwind in the pattern, extend the gear, start rolling in some flap and roll out on full-flap final, and touch down exactly where you want. I did the first flights with the airplane "clean" (no externals); adding them for subsequent flights revealed no appreciable difference in the way the model flew.

GENERAL FLIGHT PERFORMANCE

Stability: Trims established, the model easily flies "hands off"—a great confidence builder for the relative newcomer. No gyros or other stabilization devices are required, and the controls seem balanced.

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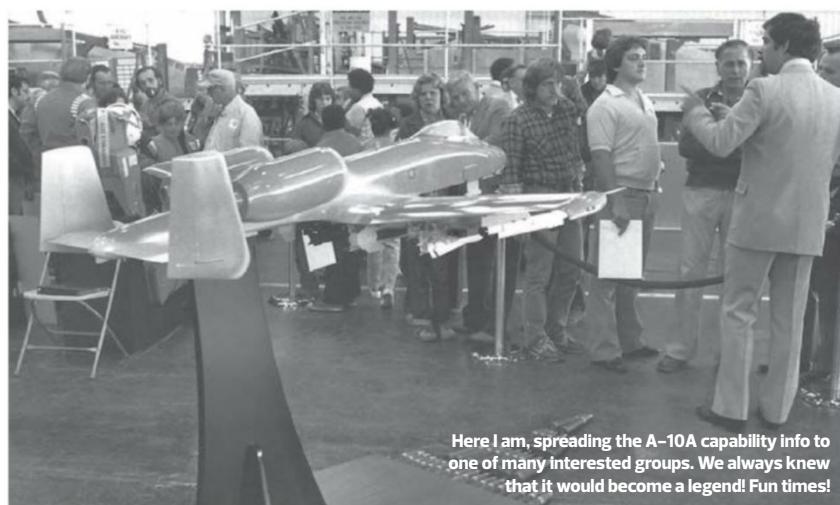
Getting A-10s into Service

My association with the A-10 began in 1976, when I joined the engineering team at Fairchild Republic. At that time, ship #30 (of 713) was just about coming off the line, and deliveries to operational Air Force units was underway. The first unit to receive our new machine was the 355th Tactical Fighter Wing (TFW) at Davis-Monthan Air Force Base in

Tucson, Arizona. The 355th had been an A-7 Corsair II unit and had been designated as the Air Force training base through which all future A-10 drivers would pass. At that time, rumor was that the existing A-7 community at Davis-Monthan was not particularly happy with the new "ride" that had been selected for them, considering the re-equipment as a step backward. Given the near Mach capability of the A-7, 400 knots in a funny-looking airplane with the twin tails, straight wing, and what appeared to be two large trash cans located aft of the wing near the top of the airplane may have seemed ludicrous. The other end of the fuselage is what made the difference. The GAU-8A Avenger 30mm cannon could spit out 70 shots per second, which meant that, when you had a moving ground target acquired, you could fly the airplane, bang the proper rudder in the direction of the target's movement, squeeze the trigger, and hose whatever was there and turn it to dust, all while watching it happen. Fun days on the Arizona desert!

I spent a lot of time in those early days at Davis-Monthan; the "Hog," as it was to be called, was new and had the typical "teething" problems of any new weapon system. A second wing of airplanes, the 354th TFW, was established at Myrtle Beach, South Carolina, followed by the 81st TFW at Bentwaters, England. The latter location was selected because the strategists decided that, if an armored invasion of Europe were to occur, a base in northeast England would be an ideal spot from which to launch tank busters, the likes of which had never been seen before. Given the climate of potential conflict, a restructuring of the Air Force's assets was implemented, allowing selected Air Guard outfits to receive brand-new, right-off-the-production-line A-10As. These went to Bradley (in Connecticut), Barnes (Massachusetts), and Baltimore (Maryland)—talk about a bunch of happy people! The Guard guys no longer had to be equipped with Air Force "hand-me-downs," and their mission stepped up significantly.

In the eight years that I was in the program, I managed to get around the world with the A-10, met some great people, shared some amazing experiences, built some long-lasting friendships, and stored away some wonderful memories. It was a great and unforgettable adventure, for which I am thankful; I often remind my wife that the A-10 even allowed us to buy our first house. Thanks, Mr. Warthog!



On the ramp, the A-10 is ready for a twilight sortie! All lights are preinstalled.

Tracking: It tracks well through the loop, with power reduced on the back side. Scale rolls are remarkably smooth and easy to perform, and require no real rudder coordination.

Glide and stall performance: Power-off stalls are gentle and straightforward; it takes a lot to disturb that big, virtually rectangular wing. The real fun thing to do, however, is a high-speed run-in, jinking with the rudder, squeezing off a two-second burst, and pulling up sharply for an over-the-shoulder visual on the havoc you've just wreaked! Cool stuff!

PILOT DEBRIEFING

On subsequent flights, I noticed that with the two Venom 5000mAh packs in the recommended position, the model was nose-heavy and couldn't be correctly balanced. Since there wasn't a lot of room to move both packs aft in tandem, I moved the location forward and stacked the packs. No hatch modification was required, and the center of gravity problem was solved. The other important issue I noted was that the packs were hot upon landing. I decided to rework the intake and exhausts on the bottom of the fuselage to allow them to work more effectively. I cut a 3x5-inch slotted plate from 1/16-inch ply, cut a matching-size hole in the fuselage bottom near the existing vents, and glued the plate in place. The packs now run significantly cooler. This model is the right size, impressive, and enjoyable to fly. For those reasons, plus others, I would get in line to buy another should anything ever happen to it.

BOTTOM LINE

The model is only provided, at this point, in a PNP (plug-and-play) configuration, and will take you a couple of hours to assemble and another hour to rig and prepare for flight. I spent more time weathering and detailing the model than I did assembling it. In addition, for those of you who may already have many of the required propulsion components on hand and feel so inclined to add additional thrust, I understand that an interchangeable 90mm nacelle-pod assembly (larger I.D. to accommodate bigger fan units) will also be available. +



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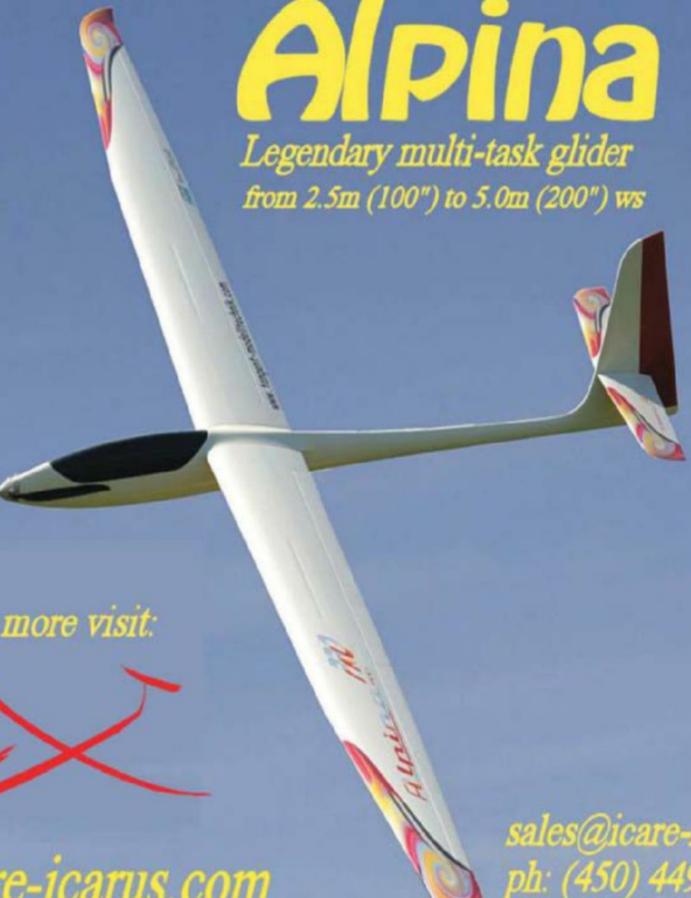
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Great Planes Ultra Sport 46 GP/EP ARF

This classic sport plane still rocks as a newly rereleased ARF

BY JASON BENSON PHOTOS BY JOHN REID



In 1989, Great Planes released a popular kit called the Ultra Sport 40, and the follow-up Ultra Sport 60 was also a huge success. Over the years, thousands of modelers have enjoyed the smooth, aerobatic flight characteristics of the Ultra Sport design. One of the most memorable models of my early RC days is the Ultra Sport 40. My good friend and I had well over 2,000 flights on ours before we retired it.



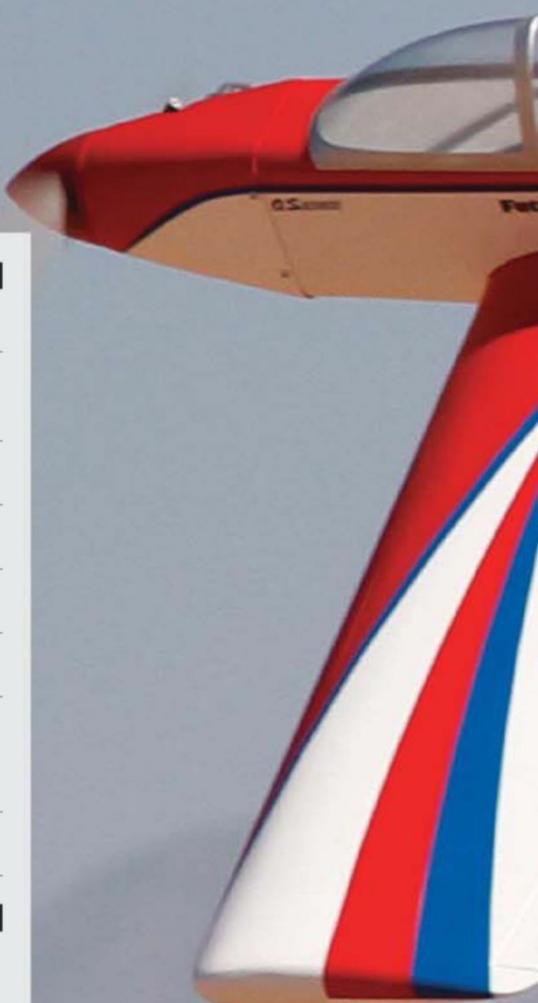
The O.S. .55AX provides plenty of power for this model.

AT A GLANCE

MODEL	Ultra Sport 46 GP/EP ARF
MANUFACTURER	Great Planes (greatplanes.com)
WINGSPAN	55 in.
PILOT SKILL LEVEL	Intermediate
ASSEMBLY TIME	Less than 10 hours
RADIO REQ'D	4- to 6-channel
POWER REQ'D	.46 to .55 two-stroke, .70 four-stroke, or RimFire .55 outrunner
PRICE	\$199.99

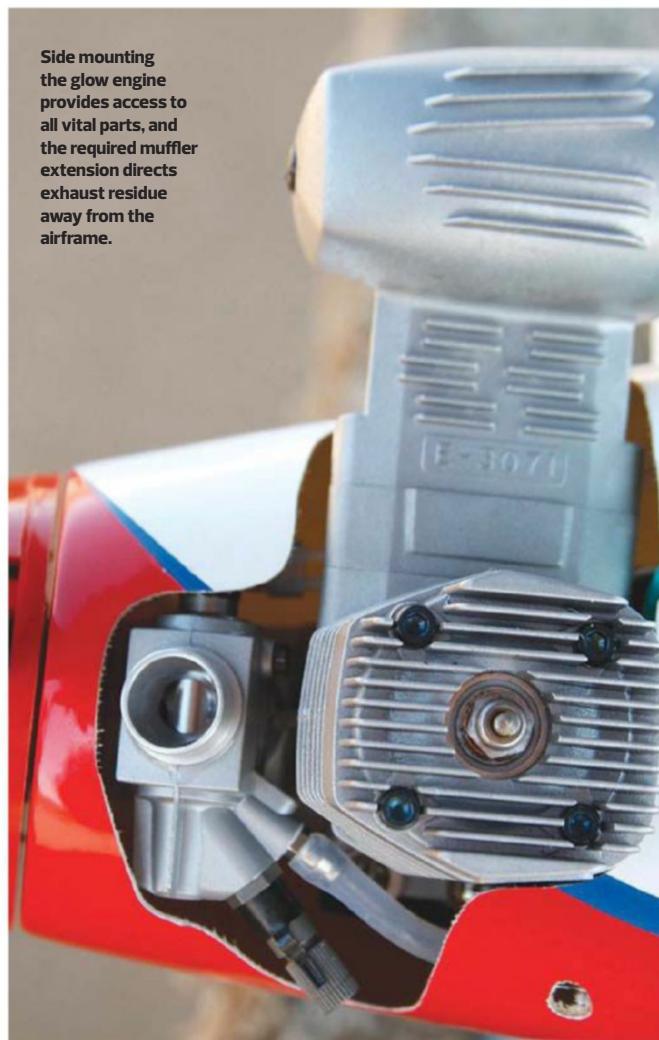
WHAT WE LIKE

- ⊕ Great color scheme and finish
- ⊕ Smooth flight
- ⊕ Quick build
- ⊕ Powerplant options





IT IS THE PERFECT PLANE TO TAKE TO THE FIELD FOR NICE, GRACEFUL AEROBATICS OR FULL-THROTTLE LOW PASSES DOWN THE RUNWAY.



Side mounting the glow engine provides access to all vital parts, and the required muffler extension directs exhaust residue away from the airframe.



Above: The preplumbed, three-line tank works well when using glow power.

Right: The included spinner fits perfectly and is matched closely in color.



The nylon wing bolts can be installed with a screwdriver or wrench to avoid stripping them.



A Futaba R617FS receiver and LiFE battery fit well in the provided area.

The Ultra Sport 46 GP/EP ARF is a built-up model that is covered in heat-shrink covering. The model is highly prefabricated right out of the box and requires little assembly. It comes with a hardware kit that includes everything needed to complete this plane and power it with a glow engine or electric motor. Control horns, pushrods, motor mount, fuel tank (for glow), and

even mechanical retracts with foam wheels are all there and of great quality. A nicely illustrated manual guides you through the build from start to finish. To finish the model off is a complete decal set so that you can detail your Ultra Sport to your liking.

I recommend this plane for the pilot at the intermediate level and above. The Ultra Sport is fast and nimble, so you will want to have at least one low-wing trainer under your belt as well as experience with a tail-dragger.

UNIQUE FEATURES

The control surfaces of the Ultra Sport come prehinged and glued in place on all surfaces except the rudder. The rudder is preslotted and just requires you to install the tailwheel and utilize the included CA hinges to wrap things up. The included mechanical retracts require that you assemble the axles and drill four holes in the mounting rails to get them flight-ready. Great Planes did a great job of simplifying the installation of the retracts, and everything lined up great with very little effort.

There are only three pieces of this model that are not built-up wood with film covering.

The first is the canopy/hatch, which comes complete and ready for flight. The second is the fiberglass cowl, which is painted to match the plane perfectly and requires that you make cutouts for your motor or engine and drill four holes for the screws that secure it. The final piece is an ABS fairing that blends the front of the wing into the fuselage; this is secured using canopy glue. For the ABS fairing, I also used my Dremel with a large drum-sanding bit to match its shape to the wheel openings in the bottom of the wing.

The decals are sticky-backed and precut to shape. You can install all or none of them depending on your taste.

The hardware appears to be a mix of metric and SAE. The screws included for mounting the engine are SAE, and this was a good thing when I stripped one; it was easy to find a spare 6-32 screw in the shop to replace it with.

I made a couple of minor modifications to the Ultra Sport. The first was to use Allen-headed screws for mounting the cowl. I did this because I prefer Allen heads on parts that could potentially need to be installed and removed several times. I also moved the throttle servo forward about

GEAR USED

RADIO

Futaba 8FG w/ R617FS receiver, five S3001 servos, one S3170G servo (futabarc.com)

ENGINE

O.S. 55AX ABL w/ stock muffler

FUEL

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PROP

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Photo courtesy of stansphotos.com

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Above: The throttle-servo mount is well designed and easy to install.

Below: The preinstalled canopy/hatch with quick release provides easy access to the components inside.



1/2 inch because, when I installed it per the directions, the pushrod was not long enough to reach the servo arm.

There were a couple of things in the manual that were a little misleading. The first is in step 5 of the "Glow Installation" section. The first photo shows the backplate spacing to be 124mm, but there is no mention of where this is measured from: the "cowling ring" or the actual firewall. After measuring, I found that it was from the firewall itself, which is about 4mm back from the ring. The second issue is the illustration in step 14 of the same section, where the servo plate is shown upside down. It is shown correctly in the picture for step 15.

IN THE AIR

The Ultra Sport 46 GP/EP ARF has small wheels. Because of this, you will want a smooth surface for takeoff and landing. If you fly at a field with a grass runway that is well maintained, you should be fine, but packed dirt or pavement are going to be preferred. Ground handling was solid and predictable. When it came time to add power for takeoff, the rudder had plenty of authority and the plane tracked straight and true.

Covering Prep

There are certain things that you can do with a new model to help it maintain that "new model" look. If you are working with a plane like the Great Planes Ultra Sport 46, which is covered with heat-shrink covering, an easy way to keep the edges of the covering in place for the life of the plane is to use MonoKote trim solvent.

Step 1 is the same as what you'd do with any film-covered plane: Set your covering iron to the proper temperature and go over all the seams and edges. Step 2 is where using heat-shrink covering is different. Wet a corner of paper towel with trim solvent. Run the wet corner over all the places where there is a seam in the covering. This really bonds the seams like nothing you have ever seen before. Step 3 is to go over any loose or wrinkled covering with your covering gun and a microfiber towel. This shrinks the covering down and smooths it out nicely.

So, there you go: my "super-secret" way to guarantee a heat-shrink covering or MonoKote-covered model will look terrific for as long as possible. I hope you give this a shot and experience the advantages I have.



The first step is to set the iron to a lower temperature.

GENERAL FLIGHT PERFORMANCE

Stability: The Ultra Sport 46 has very low wing loading and is stable in all ranges of the flight envelope. At higher speeds, I did not notice any indication of a wingtip stall while pulling hard on the elevator. In the middle of the speed envelope, the Ultra Sport felt completely in control as well. When I did finally slow the plane enough to stall the wing, there were no bad habits observed. The nose just came down until the plane regained enough airspeed to resume flying.

Tracking: The Ultra Sport tracks like it is on rails. Wherever you point it is where it will go until told to do otherwise.

Aerobatics: This is a sport aerobatic model. It performs all the standard aerobatics, such as

rolls, loops, point rolls, avalanches, snap rolls, and stall turns.

Glide and stall performance: With the retracts up, the Ultra Sport 46 is a "clean" airframe. When you pull the power back, it maintains speed well and will glide for quite a while, making landing approaches easy to maneuver.

PILOT DEBRIEFING

As I mentioned, this plane brings back a lot of great memories. It is the perfect plane to take to the field for nice, graceful aerobatics or full-throttle low passes down the runway. As powered with the O.S. 55AX, the Ultra Sport 46 has plenty of performance and speed for anything you could want to throw at it.

BOTTOM LINE

The build time of the Ultra Sport was short: less than 10 hours total, excluding glue dry time. The build was easy, and with a little planning, you will have a nice completed product. As always, take your time and read through the instructions ahead of time to familiarize yourself with the processes involved. +

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TOP GUN



WORLD-CLASS RC AIRPLANES AND PILOTS FLY AT THE ULTIMATE RC COMPETITION

This year's Top Gun Scale Invitational saw 155 world-class pilots from around the globe compete for the bragging rights in seven hotly contested classes, with just fractions of points determining the winners of each category. Spectators and competitors were treated to museum-scale models that represented every age of aviation, from early World War

Two-fisted winner Jack Diaz holds up his hardware for placing first in Expert and for being the "Mr. Top Gun" overall champion.



GTIAN

SCALE INVITATIONAL

BY THE MODEL AIRPLANE NEWS CREW
PHOTOS BY DAVID HART, BARRY VAUGHT & RICH URAVITCH



I biplanes to heavy-metal fighters, civilian sport planes, and plenty of turbine-powered jets. Event organizer Frank Tiano has been throwing this amazing RC competition/reunion/party for 29 years now, and incredibly, the event continues to grow and improve.

From its very first incarnation held in Coral Springs, Florida, in 1989, when Bob Fiorenze flew his F/A-18 Hornet

to victory, to this year's extravaganza that unfolded at Frank's Paradise Field with Jack Diaz and his Fouga Magister earning the ultimate scale prize, the annual Top Gun Scale Invitational has been a must-attend event for scale RC enthusiasts. Make your plans now to attend the 30th anniversary of this terrific event in Lakeland, Florida, May 1-6, 2018. For more information, go to franktiano.com.

MR. TOP GUN

No stranger to the Mr. Top Gun title, Jack Diaz first won with his Fouga Magister in 2015. His impressive 1/4.5-scale model was built from the Philip Avonds kit from Belgium. Jack says it is a very complex kit, which produces an extremely accurate scale model that took him a couple of years to build. The wing and stab construction is built up (balsa and ply ribs). The flaps run on bearings and rails as they do on the full-size version, and the position of the bearings and the rails' shape are scale. The speed



brakes on the wings are also 100 percent scale. All the linkages are internal in spite of the thin wing and stab profile. Landing gear and tires are also made by Philip Avonds and, again, are 100 percent scale. The scale landing lights are from Emcotec in Germany. Jack flies with a Spektrum DX18 with JR servos, and he powers the Magister with a KingTech 100 turbine. The paint scheme corresponds to the 2005 Belgian Air Force Red Devils, Solo Display aircraft.

An amazing and crisp flight shot of Jack Diaz's Fouga Magister.

TOP GUN SCALE INVITATIONAL

FROM THE FLIGHTLINE

Each year, Top Gun is more than just a scale competition. It has a lot to do with the people and friendships developed over the years. Here are some candid shots from this year's scale invitational.





5

1. Event organizer Frank Tiano (left) and Vincent Julian pose for the camera. Vincent won the Best Pre-WW II award with his Grumman F3F-2 biplane. 2. Enjoying a calm sunset, Henry Nguyen, Joe Castelao, and David Shulman (left to right) show off the scale lighting of their T-34 Mentor. 3. Ana Esteves holds Eduardo's PT-19 for an engine run-up. Notice the tiny Tiano in the cockpit. 4. Top Gun judge Bob Curry (left) calls for son Sean as he flies his Hawker Tempest. 5. Impossible to tell from the full-size aircraft, Mike Barbee's Team scale entry Beechcraft King Air makes a down-and-dirty slow-speed pass for the flight judges. 6. Jimmy Prive and family show off his beautiful Stinson SR-9, flown in Expert class. 7. Pilots and spotters on the flightline for the midday airshow.

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7





Tim Len (brown hat) flies his A-4 Skyhawk in the Sportsman class, while his caller, Greg Arnett (white hat), keeps an eye on traffic.

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Above: The official flag bearer for Team Brazil, Giovana Gastaldei kept everyone's spirits high! Right: One of the most popular jets at Top Gun was the F-16 Falcon. This one sports a paint scheme that is a salute to the older military version with its classic blue and yellow colors.



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EXPERT CLASS

Flying aircraft they built from plans or kits, entrants in this class add scale detail and modify as needed. All Expert class airplanes receive a static score and fly four flight rounds. After their lowest flight score is dropped, the average of the rest is added to their static score for a final number. This year, 21 pilots competed in this class.

**1st // Jack Diaz // Fouga Magister**

After earning 99.417 points from the static judges, Jack flew his 1/5-scale model of the '50s French primary trainer to earn 197.5 total points and his second Mr. Top Gun title. The 100-inch-span, 33-pound jet is built from the Avonds kit and is powered by an AT100 turbine. Jack controls the Magister with a Spektrum DX18 radio.

**2nd // Lance Campbell // SR-71**

Lance designed the plans for this 1/8-scale model of the Lockheed spy plane and spent nine years finishing the project. It earned 99.167 static points, and Lance used a Futaba radio to fly it to a total of 195.709 points. The 85-pound SR-71 is 13 feet long and is powered by a pair of JetCat 140-RXi turbines.

**3rd // Dave Wigley // Hawker Tempest**

Dave built this 1/5-scale British Royal Air Force fighter 20 years ago from Vailly Aviation plans and powers it with a Quadra 75cc gas engine. The 96-inch-span model earned 97.833 static points, and Dave flew it with his Spektrum DX18 radio to a total of 193.625 points.

**4th // Mike Barbee // T-34**

Mike built this 36%-scale model from enlarged Bob Patton plans and powers it with a Desert Aircraft 200cc gas engine spinning a 32x12 prop. The 136-inch-span model earned 96.833 points from the static judges and flew with Mike's Futaba 18MZ to earn 193.583 total points.

**5th // Scott Miller // MiG-15**

Scott's 1/6-scale jet from the BVM kit earned 98.667 static points, and he flew with his Spektrum DX18 radio to earn a total of 193.375 points. The 68-inch-span model is powered by a JetCat 120 SX turbine and sports a North Korean paint scheme.



6th // Scott Harris

// Yak 130

Built from the Jet Legend kit, Scott's 1/4-scale model of the Russian two-seat advanced trainer earned 95.883 points on the judges' table, and he flew it with his Spektrum DX20 radio to earn 193.250 total points. His 94-inch-long jet is powered by two K120 turbines and has a functional auxiliary air-intake system.



9th // David Hayes // Ayres Turbo Thrush

This 1/4.8-scale crop duster is David's own, new design, and he won this event with his earlier version in 2008 and 2009. This year, the 99-inch-span model earned 93.250 static points, and David flew it with his Spektrum DX9 to a total of 187.708 points. It's powered by an E-flite 160 electric motor turning an APC 19x10 prop.

7th // Kim Foster // de Havilland Moth Minor

Kim built his 1/4-scale model of the British '30s tourer/trainer from Bates planes in 1999 and flew it at the 2000 Top Gun event. His 100-inch-span model is powered by a Laser 150 spinning a Zinger 16x8 prop and weighs 16 pounds. It earned 97.083 static points and flew with a Futaba radio to a total of 192.666 points.



8th // Bob Violett // F-80C

After earning 94.583 static points with the model he designed and kits under his BVM line, Bob flew it with his Spektrum DX18 to a total of 189 points. Bob's vintage 1/6.5-scale U.S. Shooting Star is powered by an electric EVF-3-12S ducted fan system and is equipped with tank drops and speed brakes.



10th // Rick Boyer // MiG-15bis

Built from the BVM kit, Rick's 1/6-scale jet is powered by a JetCat P120 turbine and sports a Flite Metal finish and speed brakes. It earned 96.917 points on the static judges' table, and Rick flew it with a JR 10X radio to earn 186.667 total points.

TEAM CLASS

With a designated builder and a designated pilot who is also allowed to work on the aircraft, the aircraft in the Team category are static-judged. Aircraft fly four scored flight rounds. After their lowest flight score is deleted, the average is added to their static points for their overall score. Twelve teams competed in this class in 2017.

**1st // Mike Barbee & Frank Noll // Beechcraft King Air**

Built by Mike, this 1/4-scale model of the '60s private twin earned 96.833 static points, and Frank flew it with a Futaba 18MZ to earn a total of 193.416 points. Built from Bob Patton plans, the 155-inch-span model is powered by two Kontronik 22-16 Varipitch electric motors and it earned 96.333 static points.

**3rd // Larry Folk & Kurt Koelling // Top Cub**

Larry built this 144-inch-span model from the Balsa USA kit and powers it with a D&B 3.7ci twin-cylinder engine. The 1/3-scale model earned 91.917 static points, and Kurt flew it with a Spektrum DX20 to earn a total of 189.124 points.

**4th // Bob Rullie & Mitch Buckley // Me 262**

Bob built this model of the world's first operational jet-powered fighter from the Grumman kit and powers it with twin JetCat P60 turbines. It earned 94 points on the static judges' table, and Mitch flew it with a JR 12X radio to earn a total of 189.042 points.

**2nd // Mike Grady & Dustin Buescher // MiG-15bis**

Built by Mike from the BVM kit, this 1/6-scale jet is powered by an electric Vio-Fan ducted fan. It earned 92.583 static points, and Dustin flew it with a Spektrum DX20 radio to earn a total of 189.416 points.

**5th // Rod Snyder & Aarahn Stewart // T-34**

This 1/4-scale model of the military trainer has a 100-inch wingspan and is powered by a GT80 gas engine turning a Zinger 22x12 prop. Built by Rod from Mark Frankel's plans, it has Robart gear. It earned 94.750 static points, and Aarahn flew it to earn a total of 188.792 points.

6th // Phil Noel & Rei**Gonzalez // MiG-15**

Built by Phil from the Skymaster kit, this 1/4-scale jet is powered by a Jet Central Cheetah turbine. It earned 94.083 static points, and Rei piloted it with a Spektrum DX20 radio to earn 188.166 total points.

**7th // Phil Smith & Thomas Greg // P-47D**

Phil built this 110-inch-wingspan model from the CARF-Models kit and put a Moki 250cc gas engine in its nose for power. The 1/4.5-scale Thunderbolt earned 90.500 points from the static judges, and Thomas flew it with a Futaba 18MZ radio to earn 186.167 total points. The model is painted in the scheme of Capt. Joe Powers of the 56th Fighter Group.

**8th // Walt Wosko & Jesse Russell // T-6 Texan**

Walt built this 101-inch, 1/5-scale model from the Yellow Aircraft kit and powers it with a G62 gas engine turning a Menz 22x10 prop. After it earned 93.083 static points, Jesse flew it with a Spektrum DX9 to earn a total of 184.958 points.

9th // Jim McDevitt & Mike Wolvin // Hellcat

After it was awarded 91.083 points from the static judges, Mike flew the Hellcat with a Spektrum DX18 to earn a total of 184.958 points.

**10th // David Barry & Roger Nieto // Nieuport 28**

David built this 1/4-scale, 180-inch-span French WWI fighter from the Balsa USA kit and earned 92.333 static points. It's powered by a Saito 1.80GK gas engine turning an 18x6 Xoar prop. Roger flew the Nieuport with a Hitec Aurora 9 to earn 153.250 total points.



UNLIMITED CLASS

This category doesn't have a "builder of the model" rule, but it does have a single pilot throughout the event. Aircraft are static-judged, and the average of the three best flight rounds (out of four) is added to the static score. All members of the 13 teams competing this year wore matching shirts.



1st // Best in the West Jets // T-34

The same aircraft built and flown by Mike Barbee in Expert class, the Mentor scored even more points from the static judges in the Unlimited category: 98.583. Pilot David Shulman flew the monster-scale, 136-inch-span model with a Spektrum DX20 to earn a total of 196.666 points to come out on top in the Unlimited class.



3rd // Team Electric B-17 // B-17

This 1/9-scale Flying Fortress scored 95.833 points from the static judges, and pilot David Payne flew it with a Spektrum DX20 to earn a total of 192.456 points. Built from the Wingspan Models kit, the model is powered by Hacker A60 motors spinning Master Airscrew 16x10 props.

4th // Snyder Aerospots // MiG-15

This model of the Korean War Russian fighter earned 94.917 points from the static judges and was piloted by Rod Snyder with a Spektrum DX18 radio to a total of 190.417 points. Built from the BVM kit, the jet is powered by a KingTech 120 turbine.



2nd //

Team Meister Scale // Zero

This 1/4-scale Japanese Navy Zero built from enlarged Meister Scale plans was flown by Dino DiGiorgio using a Spektrum DX18 to a total 195.709 points. Powered by a Moki 215cc gas engine turning a 26x16 prop, the 118-inch-span model earned 97.667 points on the judges' table.





5th // Team Brazil // MiG-15

This 1/4-scale jet is powered by a K210 turbine and earned 93.167 points from the static judges. Pilot Gabriel Pellegrini flew it with a Futaba 18MZ to earn a total of 188.917 points. Team members all hail from South America.



6th // Team Yak 130 // Yak 130

Built from the BVM kit, this 1/4-scale Russian jet trainer is powered by a Jet Central Cheetah turbine. Pilot Randy Clark flew it with a JR 28X radio to earn a total of 187.959 points.



7th // Team Falcon Props // RV-4

Powered by a 3W 106cc twin engine turning a Falcon 26x12 3-blade prop, this 44%-scale American light home-built plane earned 90.417 static points. Pilot Curtis Switzer flew it with a Booma RC radio to earn a total of 185.500 points.



8th // Team Ultimate Jets // A-12 Oxcart

This 1/8-scale '60s CIA recon jet earned 90.250 points from the static judges. Barry Raborn used a JR 12X radio to fly it to earn a total of 181.125 points. The all-carbon-fiber model is powered by two BF140 turbines.



9th // Team CMJ & Sons // P-51D

Built from the Fisher RC kit, this 1/3.5-scale American fighter is powered by a Klom 310cc 4-cylinder engine, and it earned 88.250 points on the static table. Pilot Tom XYZ flew it with a Spektrum DX18 to earn a total of 180.958 points.



10th // Team Tigercat // F7F-3

This 1/6-scale fire bomber is powered by two Moki 180 engines turning 25x16 3-blade props. Pilot Dean Copeland flew it with a Futaba 18MZ to earn a total of 149 points after it earned 91.750 points from the scale judges.

X CLASS

Now in its second year at Top Gun, the X class is open to only ARF models, either painted in the mold or covered from the manufacturer. The builder is encouraged to add additional paint and markings, but no covering may be removed or replaced. Scale details like hatches, pitot tubes, and ordnance are allowed. All these models are static-judged, and the average of the three best flight rounds (out of four) is added to the static score. Fifteen pilots competed in this class.

**4th // Greg Arnette // F-16C**

A BVM PNP, Greg's 1/5-scale Fighting Falcon received 93.833 points from the static judges, and Greg flew the 120-inch-long jet with a Spektrum DX18 radio to earn 189.708 total points. It is powered by an EVOjet 220 turbine and sports the color scheme of the Arkansas Air National Guard.

**5th // Dino DiGiorgio // Tucano**

A new ARF release from Juniaer Modelismo, Dino's 1/5-scale model of the Brazilian turboprop trainer earned 92.000 points on the static judges' table. It's powered by a DLE 50cc gas engine turning a Falcon 22x10 prop, and Dino flew it with a Spektrum DX18 to score a total of 188.958 points.

1st // Dustin Buescher // F-16

This BVM ARF model of the U.S. Air Force jet scored 96.083 points on the static judges' table, and Dustin used a Spektrum DX20 to fly it to earn a total of 193.041 points. The 96.5-inch-long model is powered by a KingTech 210G turbine.

**2nd // Rob Lynch // F-16C**

This 1/5-scale jet is a BVM ARF that's powered by a Jet Central Mammoth turbine. It earned 94.250 static points, and Rob flew it with a Spektrum DX20 radio to earn 191.625 total points.





6th // Greg Foushi // F-16

This 1/6-scale BVM model was awarded 93.167 points by the static judges, and Greg flew it with a JR 28X radio to earn 187.209 total points. The 36-pound jet is powered by a KingTech 120 turbine.



9th // Ken Thornton // P-47

This 1/5-scale Thunderbolt earned 89.093 static points, and Ken flew it with his Futaba radio to 179.416 total points. The 92-inch-span warbird is powered by a Desert Aircraft 85cc gas engine and is equipped with Robart retracts.



7th // Steve Harris // F-16

Another BVM ARF, this 1/5-scale jet is 80 inches long and is powered by a KingTech 210 turbine. Equipped with a functional canopy, speed brakes, and smoke, this Fighting Falcon earned 87.583 static points, and Steve flew it with a Spektrum DX20 radio to earn a total of 184.250 points.



8th // Brad Hughes // F-16

Decked out in a Desert Storm scheme, this BVM jet earned 87.750 points on the static judges' table. The 98-inch-long aircraft is powered by a KingTech 140 turbine, and Brad flew it with a Spektrum radio to get 183.000 total points.



10th // Jon Hay // Meteor LTR-1A

This 1/3-scale E-Com ARF of the Laird-Turner racer was awarded 84.333 points from the static judges, and Jon flew it with his Futaba radio for 146.875 total points. The 95-inch-span plane is powered by a DLE-111 twin-cylinder engine turning a 28x10 prop.

PRO JET CLASS

Pilots in this class must have already placed (twice!) in the top three spots of an Academy of Model Aeronautics (AMA) competition or in the top 30 percent of a Top Gun field. Each pilot is awarded 25 static points for showing scale documentation; this is added to the average of the best three out of four flight rounds for the total score. This class saw 17 pilots in competition.

**1st // Franco DiMauro // T-33**

To come out on top in this class, Franco flew his Shooting Star with a Spektrum DX18 radio to earn a 123.417-point average flight score. The 1/4-scale Fei Bao jet is powered by a KingTech 210 turbine and has a 100-inch wingspan.

**2nd // Peter Goldsmith // MB-339**

Coming in a close second with a 123.167-point flight score, Peter's 1/3.5-scale Aermacchi jet has a 111-inch wingspan and is powered by a KingTech 210 turbine. Peter built it from the Air World kit, and he flies it with a Spektrum DX20 radio.

3rd // Brian O'Meara // F-104

Brian used his Futaba 18MZ radio to fly his 1/4-scale Starfighter and earn 122.333 points. Powered by a Behotec 220 turbine, the jet is from the Air World kit and is 14 feet long.

**4th // Rob Lynch // Cougar F9F**

A BVM jet, Rob's 1/5.8-scale Cougar is outfitted with landing lights and speed brakes, and is powered by a JetCat P60 turbine. Rob flew it with his Spektrum DX18 radio to earn 121.125 points.

5th // Jack Diaz // L-39

Besides winning the coveted "Mr. Top Gun" title, Jack also earned 120.875 points to place fifth in the Pro Jet class! His 1/5-scale Albatros is a BVM jet that's powered by a KingTech 140 turbine and controlled by a Spektrum DX18 radio.





8th // Gerardo Diaz // Cougar F9F

Gerardo flew his 1/5-scale Skymaster jet to earn 120.833 points. His 92-inch-long model is powered by a Jet Central Rhino turbine and weighs in at 35 pounds.



7th // Andreas Gietz // Su-30 Mk II

This 1/6-scale model of the Russian Air Force fighter is from CARF-Models, and Andreas flew it with his Graupner MC-32 radio to earn 119.958 points. The 118-inch-long jet is powered by two BF140 turbines.



9th // Lior Zahavi // T-33

Top Gun's first pilot from Israel, Lior flew his Jet Model Products 1/6-scale T-33 with a JR 12X radio to earn 119.750 points. His 85-inch-span aircraft is powered by a JetCat P140 turbine.



10th // Boli Muentes // F-16

This 1/6-scale BVM jet is powered by a Jet Central Cheetah turbine and weighs in at 33 pounds. Boli used a JR 28X radio to fly it and earn 119.500 points.



PRO PROP CLASS

Pilots in this class must have already placed (twice!) in the top three spots of an AMA competition or in the top 30 percent of a Top Gun field, and this year, eight pilots were eligible and competed. Each Pro Prop class pilot is awarded 25 static points for showing scale documentation; this is added to the average of the best three out of four flight rounds for the total score.



1st // Will Berninger // T-34C

With 122.583 points for the win in this class, Will's 1/3.7-scale Mentor is built from Bob Patton plans and is powered by a 3W 110 inline engine. It's equipped with a functional canopy, brakes, and lights, and is controlled by a Futaba 18MZ.



3rd // Eduardo Esteves // PT-19

Powered by a DLE 60 engine, Eduardo's scratch-built 1/3-scale model of the primary trainer has a 110-inch wingspan and weighs 32 pounds. He used a Spektrum DX18 radio to earn 119.667 points.



4th // David James // SPAD VII

This 1/4.5-scale Thunderbolt is from CARF-Models and was built by FTE. The 110-inch-span warbird is powered by a Moki 250 turning a solo 30-inch prop, and Franco used a Spektrum DX18 radio to fly it and earn 121.292 total points.



2nd // Franco DiMauro // P-47

This 1/4.5-scale Thunderbolt is from CARF-Models and was built by FTE. The 110-inch-span warbird is powered by a Moki 250 turning a solo 30-inch prop, and Franco used a Spektrum DX18 radio to fly it and earn 121.292 total points.

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5th // Sean Curry**// Tempest Mk V**

A ZDZ 90 engine turning a Bold 28x10 prop powers this 1/5-scale model of the British WW II fighter. Built from Vailly Aviation plans, the 97-inch-span model is controlled by a Futaba 18MZ radio and scored 116.000 total points.

**6th // Curtis Switzer // Curtiss B-2**

This 14-foot-span, twin-engine WW I bomber earned a total of 115.500 points. The 1/8-scale model is powered by a pair of Saito 1.80 four-stroke engines, each spinning an APC 18x6 prop. Curtis flies it with a Jeti DS16 radio.

**7th // John Welcome // P-51**

Powered by a 3W 85cc gas engine, John's Mustang is controlled by a Futaba 18SC radio and earned 109.667 points on the flightline. The 102-inch-span P-51 was build from a Bud Nosen kit.

**8th // PJ Ash // MiG-3**

This 81-inch model of the Soviet WW II interceptor/fighter is a ESM ARF that PJ refinished in the Western Front scheme. It's powered by an EME 55cc engine turning a Falcon prop. PJ flew it with his Spektrum DX18 to earn 106.625 total points.

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SPORTSMAN CLASS

To compete in this class, pilots must have flown in an AMA competition but not have finished in the top three spots at any two events or higher than the top 30 percent of any class at a previous Top Gun event. Having scale documentation adds 25 points to each pilot's overall score and is combined with the average of the best three out of four flight rounds for the total score. Sportsman is the most popular class at Top Gun, and this year, 56 pilots competed in this category.

**1st // Jose Melendez // Hawker Hunter**

This 1/4.5-scale model of the British mid- to late-'50s fighter is powered by a Jet Central Rhino turbine and is equipped with a UniLight system. Jose flew the 125-inch-long jet with his Spektrum DX18 radio to earn 121.375 total points to win this hotly contested class.

**3rd // Chad Cotsamire // P-47N**

Built from Ziroli plans, Chad's 92-inch-span Thunderbolt is powered by a Quadra 75cc engine turning a Xoar 24x10 prop. Chad controls the warbird with his Futaba 18MZ radio and earned 119.000 total points.

**4th // Jimmy Safie // F-16**

Sporting an Alaska Air National Guard color scheme, this 1/6-scale BVM jet is powered by a JetCat P140-RXi turbine. Jimmy flew the 96-inch-long jet with his Spektrum DX18 radio to earn 118.958 points.

**2nd // Tim Len // A-4 Skyhawk**

Powered by a JetCat 180-RXi turbine, this 1/5.5-scale model of the late-'50s U.S. attack aircraft is a Skymaster jet that sports a scheme hand-painted by Tim. The 86-inch-long jet is controlled by a Spektrum DX20 radio and scored 119.917 total points.

**5th // Jimmy Davis // PT-17**

This 1/3-scale Stearman is powered by an Evolution 160 radial engine turning a Falcon 28x12 prop. Built from the World Models kit, the 116-inch-span plane is controlled by a Futaba 18MZ radio and earned 117.958 points.





6th // Marvin Alvarez // F-15C

This 109-inch-long, 1/7-scale Fei Bao Eagle is painted in the Louisiana Air National Guard scheme commemorating the 40th anniversary of the F-15's entry into active service. Marvin flew it with a Jet Central Mammoth turbine and a JR XG14 radio to earn 117.708 total points.



7th // Brandon Gell // L-39

Brandon originally entered a 1/10-scale Su-37 Flanker, but a mechanical problem required him to switch to an L-39 Albatros. He flew it with his Futaba 18MZ radio to earn 117.667 points.

8th // Salvador Becherano // T-33

Powered by a KingTech 180 turbine, this 1/4.5-scale Fei Bao Shooting Star is controlled by a Jeti radio. While his total score of 117.375 points tied that of seventh-place Lou Cetrangelo, Salvador's lowest flight score (usually thrown out) was higher and gave him the edge.



9th // Lou Cetrangelo // Corsair FG-1D

Powered by a DLA 128cc 4-cylinder engine, this 1/5-scale Corsair was built by Lou from Ziroli plans. The 93-inch-span warbird has Robart retracts, and Lou used a Spektrum DX18 radio to earn 117.375 total points.



10th // Mike Hague // T-6 Texan

Built from the Yellow Aircraft kit, this 1/5-scale Texan is powered by an O.S. GT60 turning a Xoar 24x8 propeller. The 101-inch-span warbird has Robart retracts, and Mike used a Spektrum DX18 to fly it to earn 117.333 points.

SPECIAL AWARDS



AWARD	SPONSOR	PILOT	AIRCRAFT
Expert High Static	Zap Glue	Jack Diaz	Fouga Magister
Team High Static	Red Bull	Mike Barbee	King Air
Unlimited High Static	<i>Model Airplane News</i>	Joe Castelao	T-34
X-Class High Static	Falcon Props	Ray LaBonte	BAE Hawk
Best Civilian Runner-Up	Spektrum	Joe Castelao	T-34
Best Civilian (Pilots' Choice)	Ray & Robin's Hobby Center	Sean Curry/Bob Gonzalez	Cessna 421C
Best Military Runner-Up	Falcon Props	Juan Alvarez	F-104
Best Military (Pilots' Choice)	Horizon Hobby	Mike Barbee	King Air
Best WW II	Aircraft International	Franco DiMauro	P-47
Best Biplane	EZ Balancer	Gary Mills	Stearman
Best WW I	Balsa USA	David James	SPAD
Best Pre-WW II	Warbirds Over the Rockies	Vincent Juliano	F3F-2
Best Jet	KingTech Turbines	Tim Len	A-4 Skyhawk
Best Pro-Am Pro	Cortex Demon Gyros	Rei Gonzalez	Hawker Hunter
Best Pro-Am Sport	Elite Aerospots	Chad Asmus	Nieuport
Best Multi-Performance	Horizon Hobby	Mike Grady	B-17
Engineering Excellence	Robart Mfg.	Lance Campbell	SR-71
Outstanding Craftsmanship	Micro Fasteners	Rick Boyer	MiG-15
Best Unlimited Showing	Zap Glue	Team Tigercat	F7F
Top Buns Award	Fly Girls	Lior Zahavi	N/A
Special Recognition	Robart Mfg.	Bret Becker	XB-70 Valkyrie
Special Recognition	<i>Model Airplane News</i>	Lou Cetrangelo	F4U
Critic's Choice Runner-Up	FTE	Mike Barbee	King Air
Critic's Choice	Zap Glue / <i>Model Airplane News</i>	Lance Campbell	SR-71





SPECIAL RECOGNITION





DETAILS COUNT!

A static judge's perspective

TEXT & PHOTOS BY **RICH URAVITCH**

I have been privileged to serve as the craftsmanship judge for the Expert category at Top Gun for nearly the past decade. Prior to that, I was a competitor in both the Team and Expert categories. This combined level of participation at this prestigious event provides me the unique opportunity to speak from both sides of the judging table.

Over the years, I've watched some pretty magical and impressive things happen at the Top Gun Invitational RC scale event. Models have grown dramatically in size, complexity, sophistication, and quality. The trickle-down effect has obviously impacted the everyday sport scale modeler because the interest in scale is evident right down to the local field level. Obviously, suppliers of product recognize it also; just look at the types of models being offered to the consumer these days. Hard to believe, but some of the ARFs available today rival the models being flown at Top Gun during the early years!

Among the other obvious changes between now and then is the huge presence of turbine-powered scale jet models. What we could only once dream of is now not only a reality but also readily available and proven. When Frank Tiano premiered the event 29 years ago, there were 40 invited competitors in two classes of competition. This number has grown to 146 with the addition of new classes that are designed to accommodate the ever-changing face of RC scale modeling. And what about sophistication and complexity? We now have 18- to 24-channel computer radios; huge displacement, four-stroke radial engines and all-composite airframes; turboprops; counterrotating propellers; all-metal construction—the list goes on and on. We see all of this now and it really does beg the question: Where can we possibly go from here in RC scale? I must admit, it is getting more and more difficult to predict.

Top Gun static judging is broken into three areas to be evaluated: accuracy of outline; finish, color, and markings; and craftsmanship, with an overall realism evaluation also thrown into the mix. Each model is critiqued against a data package, prepared and presented by the

1

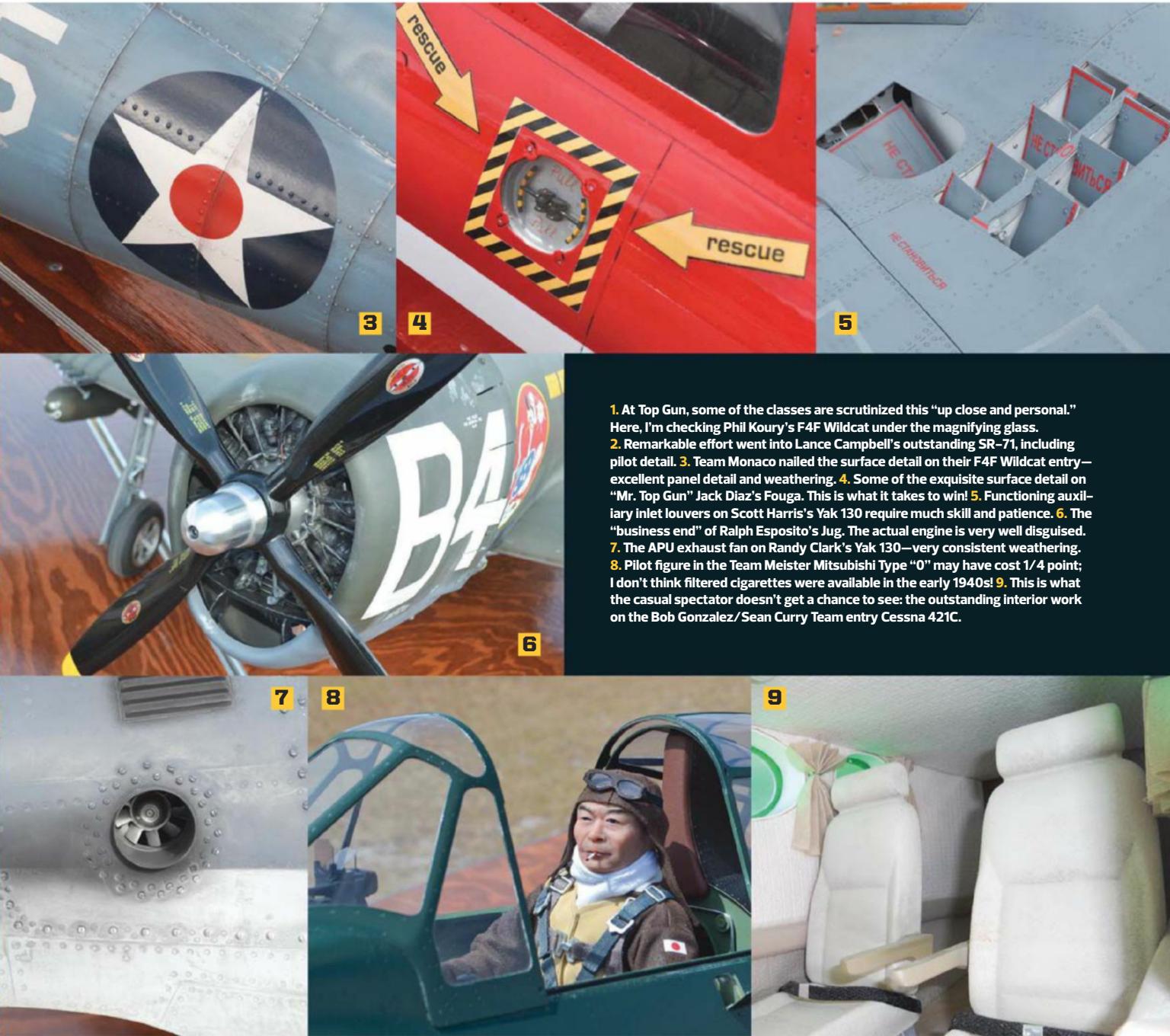


2



competitor, called the "Documentation Package." It provides all the drawings and source verifications required to validate the specific airplane the competitor has chosen to replicate. While the static judging of the outline and color categories is performed from a distance, Top Gun is unique in that the craftsmanship judge is permitted to examine the entry from essentially "zero" distance—nose to nose, so to speak. This provides the judge the opportunity to evaluate all the extra effort extended by the builder to ensure that the model can withstand all this microscopic scrutiny. Can this make a difference in scores? Absolutely!

In addition, the overall realism evaluation, scored 1–10 points, can significantly alter the final static score. It is evaluated independently and is designed to answer the question "Just how realistic does that model look overall—does it look like a well-executed model or a scaled-down version of a real airplane?" The realism score is not an average of the three



1. At Top Gun, some of the classes are scrutinized this "up close and personal." Here, I'm checking Phil Koury's F4F Wildcat under the magnifying glass.
2. Remarkable effort went into Lance Campbell's outstanding SR-71, including pilot detail.
3. Team Monaco nailed the surface detail on their F4F Wildcat entry—excellent panel detail and weathering.
4. Some of the exquisite surface detail on "Mr. Top Gun" Jack Diaz's Fougou. This is what it takes to win!
5. Functioning auxiliary inlet louvers on Scott Harris's Yak 130 require much skill and patience.
6. The "business end" of Ralph Esposito's Jug. The actual engine is very well disguised.
7. The APU exhaust fan on Randy Clark's Yak 130—very consistent weathering.
8. Pilot figure in the Team Meister Mitsubishi Type "O" may have cost 1/4 point; I don't think filtered cigarettes were available in the early 1940s!
9. This is what the casual spectator doesn't get a chance to see: the outstanding interior work on the Bob Gonzalez/Sean Curry Team entry Cessna 421C.

airframe component scores; it stands alone. If a builder were to produce a "perfectly crafted" model scoring "10" in the three airframe areas but the completed package still appeared to be more model than replica, the realism score would likely reflect that lack of realism.

Each model is judged independently according the same rules, and in the end, the scores always tell the story. No specific type or period of model has an advantage in the static-judging phase; some have distinct advantages when it comes to flying, but even then, the flying scores can differ by mere fractions of points. If everything goes well, you fly the best you ever have, your building/finishing abilities are recognized and rewarded, and there's good karma in the air, you win. It's that simple, and anyone can win on a given day. Anyone who thinks it not that important to "sweat the details" is better off declining the coveted invitation and participate as a spectator.

There are so many outstanding examples of skills, both building and flying, at Top Gun that it would be impossible to describe all of them. That's why we're showing you so many pictures with additional images on ModelAirplaneNews.com/road17.

I'm not sure of where it can all go from here, but I will say that, based on my chats with a number of competitors, next year's 30th-anniversary edition might just showcase some of the best scale RC models ever. It is an exciting, inspiring event that can't help getting you pumped up for more. Join us in 2018! †

E-flite/Horizon Hobby UMX Waco BL

Proof that good things come in small packages!

BY LARRY COOPER PHOTOS BY JOHN REID



This scale Waco is a small plane that has enough power to fly outside on a baseball diamond or even inside a gymnasium as its lightweight foam construction and diminutive size make it an ideal indoor flier. It comes fully assembled and ready to fly with all of its micro servos, hinges, linkages, and motor installed. The included instructions are well illustrated and easy to understand.

Straight out of the box, this is how the Waco looks: completely assembled and ready to go.



AT A GLANCE

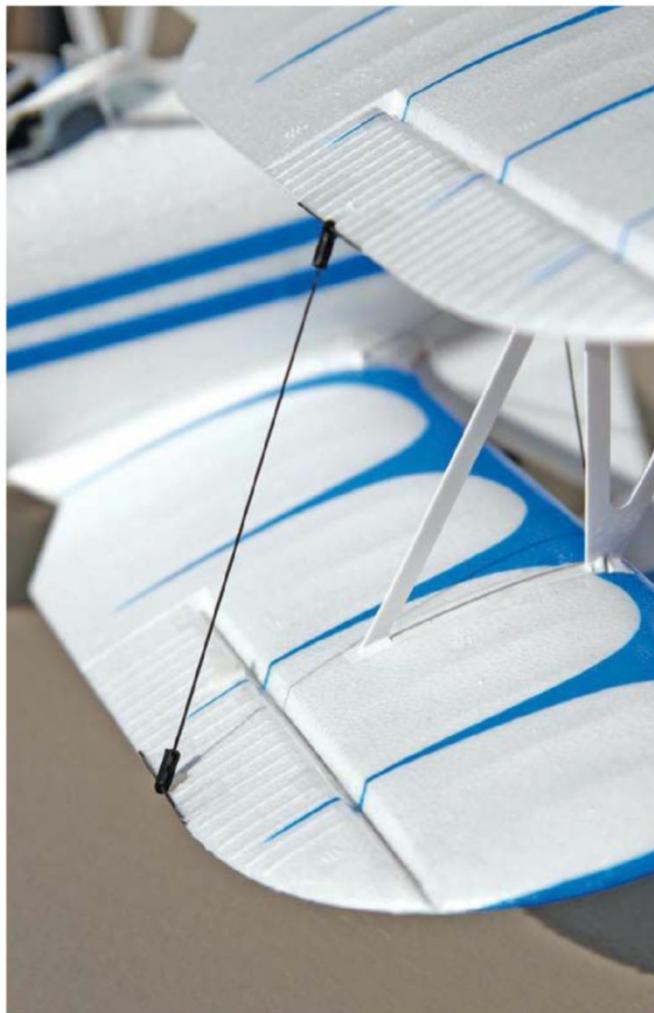
	MODEL UMX Waco
	MANUFACTURER E-flite (e-fliterc.com)
	DISTRIBUTOR Horizon Hobby (horizonhobby.com)
	WINGSPAN 21.7 in.
	PILOT SKILL LEVEL Intermediate
	ASSEMBLY TIME None
	RADIO REQ'D 4-channel DSM2/DSMX-compatible
	POWER REQ'D 2S 280mAh LiPo
	PRICE \$129.00

WHAT WE LIKE

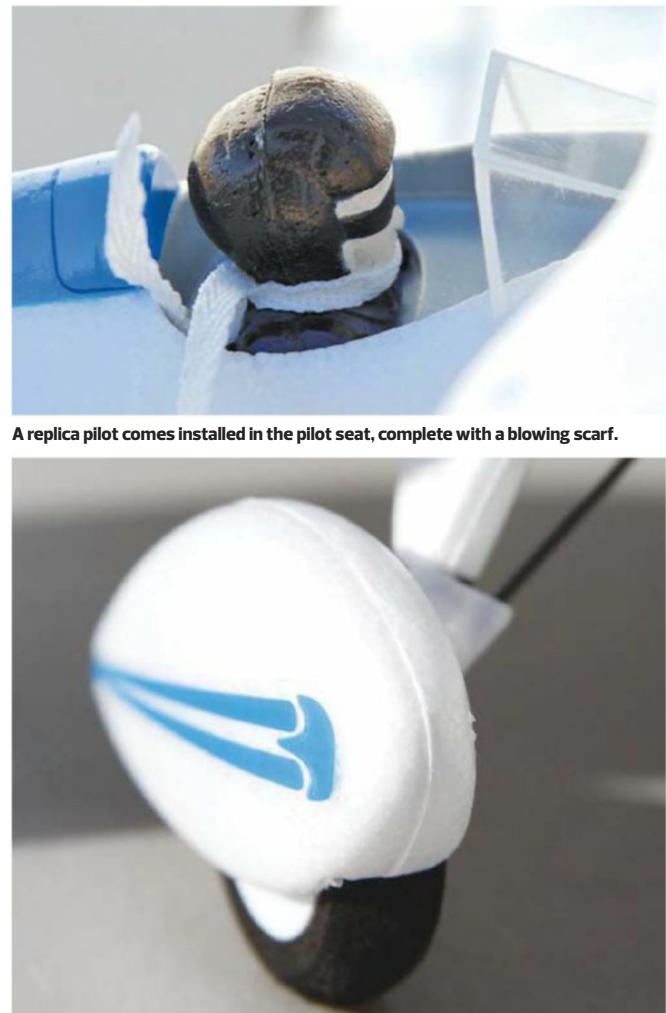
- ⊕ Handful of fun
- ⊕ Light as a feather
- ⊕ Easy to fly
- ⊕ Giant plane in a tiny package



IT HAS A LOT OF POWER FOR SUCH A SMALL
PLANE AND WILL CLIMB AGGRESSIVELY WITH A
MERE PUSH OF THE THROTTLE STICK.



The two wings are connected with struts and pushrod wires.



The main gear are attached to the fuselage with struts and a supporting spring-steel wire. They are nicely finished wheel pants.

The Waco has fixed main landing gear, and the wheels are streamlined inside nicely finished wheel pants. A steerable tailwheel allows it to taxi on the ground.

The Waco has ailerons in addition to the rudder and elevator, and the control surfaces have plenty of throw, making it very responsive

and a good choice for an intermediate pilot. Its AS3X stabilization technology keeps it nice and steady in the air.

The Waco comes in a box that can be used as a carrying case. Molded Styrofoam cradles the plane, and two braces fit over the top of the fuselage to hold it in place and protect it.

UNIQUE FEATURES

The Waco's ailerons, elevator, and rudder are all hinged at the factory. The micro servos are concealed, and the linkages are so cleanly installed that they are barely visible. The linkage wires all have U-bends that let you adjust the trim on each control surface.

The Waco's wheel pants and engine cowl have the same detailed finish as the rest of the plane. Both of the wings are connected by struts and wires, which are a nice detail, echoing the plane's historic look. Adding to authenticity is a scale pilot nestled behind the rear cowl, and he even has a neck scarf that will blow in the breeze.

The installed 180BL, 3000Kv outrunner motor is hidden beneath a cowl that is a nicely

installed decal to look like a radial engine. This little motor delivers plenty of power through the entire throttle range. The top of the cowl is held in place with two rare-earth magnets, and the fit is so good that the seam is barely visible. Removing the cowl also gives you access to the battery compartment, and hook-and-loop material is already installed to hold the battery in place. The opening is more than adequate for installing and removing the recommended 2S LiPo pack.

The main landing gear are fixed and held to the plane with streamlined struts that extend from the bottom of the fuselage. They are reinforced with spring steel, which makes them very shock absorbent in the event of a hard landing. The wheels themselves are covered with wheel pants but protrude below the pants to easily roll on a smooth surface. A tiny steerable tailwheel is attached to the bottom of the rudder and is also supported with a spring-steel strut.

You'll need a DSM2/DSMX transmitter to control the plane. The Waco comes with Bind-N-Fly technology, and binding the radio to the

GEAR USED

RADIO

Spektrum DX6i (spektrumrc.com); micro linear long-throw servos (installed)

MOTOR

180BL 3000Kv outrunner (installed)

PROP

5.75x2.5 (installed)

BATTERY

E-flite 2S 280mAh 30C LiPo (e-fliterc.com)



The top of the engine cowling comes off, providing easy access to the battery compartment. The brushless outrunner is concealed beneath the engine cowl.

plane takes all of 30 seconds. The instructions recommend using dual rates, so I programmed that in as well.

IN THE AIR

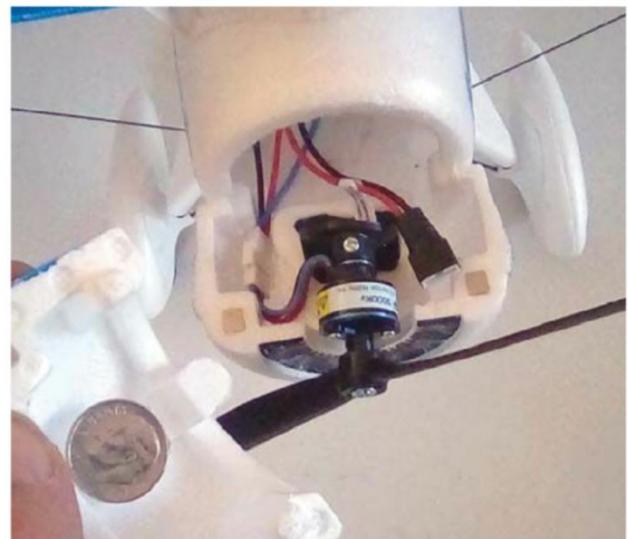
The Waco is small enough to fly indoors or out. Its sturdy landing gear give you the option to take off from a smooth surface, but it is a breeze to hand-launch if you need or want to. It can easily be flown on the infield of a baseball diamond. It has a lot of power for such a small plane and will climb aggressively with a mere push of the throttle stick, getting into the air in about 20 feet or so. It needs a little power for landing and will glide into the landing easily and predictably with the speed just slightly up. I just let it descend at a slow speed and let it touch down and roll out with the throttle back. Once on the ground, it will taxi easily, and you can literally drive it back to your feet with ease.

GENERAL FLIGHT PERFORMANCE

Stability: Not much throttle is needed to keep the Waco stable, and it is fun to see just how slow you can get it to fly.

A Matter of Balance

To achieve your plane's desired flight characteristics, you need to make certain that the plane is properly balanced, both side to side and front to back. The side-to-side balance is usually not an issue, and most planes are just naturally balanced on that axis. Front to back, however, is another issue. Small things, like a tailwheel, can shift the balance toward the rear and make it tail-heavy. Tail-heavy planes are difficult to fly and don't respond nicely to the radio inputs. The solution to achieving balance is to add a bit of weight to the front of the plane to make it just slightly nose-heavy. My Waco was just slightly tail-heavy and required additional weight in the front. I added a dime to the inside of the motor cover and then it balanced perfectly.



PILOT DEBRIEFING

This diminutive beauty gives you all the features of the big planes, including great flight characteristics and beautiful scale looks. It is just great fun to toss around in the sky, and it gives you the confidence to improve your skills because you always are in complete control. From takeoff to landing, it is a blast to fly.

BOTTOM LINE

The E-flite Waco is a terrific model of a classic plane. Its designers' obvious attention to detail makes it not only look great but also fly great. They have left nothing to chance with this little beauty, and you will be delighted with how fun it is to fly. It is a handful of fun right out of the box. +

E-flite/ Horizon Hobby Opterra 2m Wing

A perfect flying wing for FPV flying

BY JASON BENSON PHOTOS BY JOHN REID



For years, E-flite has been pushing the limits with its plane designs, and the new Opterra is no exception. This aerial video/FPV platform has something for everyone, and even if you don't want to outfit it with a camera, it will definitely keep you entertained.

The Opterra is constructed completely out of carbon-reinforced Z-Foam that has been hollow-molded to keep weight at a minimum. I reviewed the BNF (bind-and-fly) version, which comes an AS3X receiver with SAFE Select technology that you can bind to your DSMX/DSM2-compatible 5-channel radio; it's also available PNP (plug-and-play), which would require a receiver and radio. Both versions need a 3-cell 2200-3200mAh LiPo to get airborne. The Opterra wing comes with an optional camera nose with up to two forward-facing stations for FPV or HD cameras as well as a downward-looking camera bay in the belly, designed for a GoPro-style camera.

Pilots transitioning from their first trainer will appreciate the SAFE Select flight stability, which allows them to set up the plane to suit their flight skills, and more advanced pilots will appreciate the Opterra's ability to capture aerial video and still shots. Also, if you are part of the growing group of FPV pilots, the Opterra can be outfitted with an FPV system for any number of activities. This plane really has something for everyone.



AT A GLANCE

MODEL
Opterra 2m Wing BNF
Basic w/ AS3X

MANUFACTURER
E-flite (e-fliterc.com)

DISTRIBUTOR
Horizon Hobby (horizonhobby.com)

WINGSPAN
78.3 in.

PILOT SKILL LEVEL
Intermediate

ASSEMBLY TIME
15 minutes

RADIO REQ'D
5-channel DSMX/DSM2-compatible

POWER REQ'D
3S 2200-3200mAh LiPo

PRICE
\$229.99

WHAT WE LIKE

- ✚ Versatile
- ✚ Fun
- ✚ Wide flight envelope
- ✚ Easy to fly

SAFE Select technology
makes launching the
Opterra a nonevent.





PILOTS TRANSITIONING FROM THEIR FIRST TRAINER WILL APPRECIATE THE SAFE SELECT FLIGHT STABILITY, WHICH ALLOWS THEM TO SET UP THE PLANE TO SUIT THEIR FLIGHT SKILLS, AND MORE ADVANCED PILOTS WILL APPRECIATE THE OPTERRA'S ABILITY TO CAPTURE AERIAL VIDEO AND STILL SHOTS.

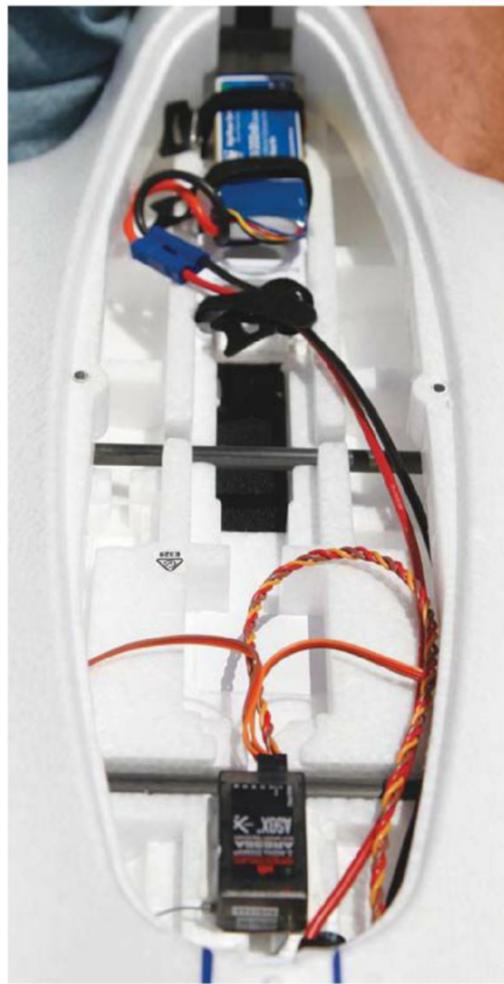


FPV Wings

If you'd like to check out what all the hype is about regarding FPV flying and hone a new skill set (flying "drones"), an FPV wing is worth looking into. FPV flying wings are getting more popular, and they are flying better every day. With the introduction of technology like AS3X, you can easily move into the FPV world. The key is to get some equipment and give it a shot. You'll be surprised how much fun it really is.

There are a few fun activities to do with an FPV wing. Find a fellow club member who will go up and fly the pattern while you play "chase plane." With a little practice, you will find yourself flying nice, tight formations effortlessly. It's almost like being your own Blue Angel demo team! It is also fun to go up and explore your surroundings. You might be surprised at what is on the other side of the tree line or hill at your field. Finally, an FPV flying wing can help your fellow pilots locate a downed plane. This can shave hours of search-party duty for everyone and get you all back to flying ASAP.

So get out there and give it a try. I think you'll enjoy it.



There is plenty of room under the canopy for FPV equipment and the battery of your choice.

UNIQUE FEATURES

There are only two control surfaces on the Opterra: elevons that provide both elevator control and aileron control. Both of the surfaces arrive prehinged and ready for flight. The hinges are pressed into the Z-Foam and will provide years of use. In addition to the carbon-fiber reinforcements and the Z-Foam parts, there are a host of ABS plastic fittings and pieces. All come 100 percent ready to be assembled and flown with no additional work needed. Now let's talk about my favorite part: All the decals are

preapplied for a great-looking design.

You literally don't need a single tool to assemble this plane and fly it. The only fasteners you will use are the plastic cam locks for the wings and winglets. Everything else comes



preinstalled and ready to go.

I made no modifications to the Opterra when I assembled it. As a matter of fact, the end of the box boasts a "simple as 1, 2, 3" statement, so I decided to put it to the test. I charged my E-flite 2200mAh LiPo battery the night before and did absolutely nothing to the Opterra prior to arriving at the field. I didn't even open the box. On the morning of the photo shoot, I cut the tape from the box and dug in. West Coast senior editor John Reid was not amused and went off to fly his drone. By the time he had flown one battery, I had the Opterra assembled, bound, and ready to fly—nice work, E-flite!

IN THE AIR

The Opterra is what I like to call a "chuck and skid" model. This means that you have to throw it for takeoff and skid it in on landing, so a grass field is optimal. I flew it off our dirt runway, however, with no problem, and the preinstalled skids did a great job of protecting the bottom of the plane.

GENERAL FLIGHT PERFORMANCE

Stability: On my first few flights, I was flying fast and executing pylon-style turns with no stall present. At slow speeds, the Opterra handles

GEAR USED

RADIO

Spektrum DX9 (spektrumrc.com); servos installed

MOTOR

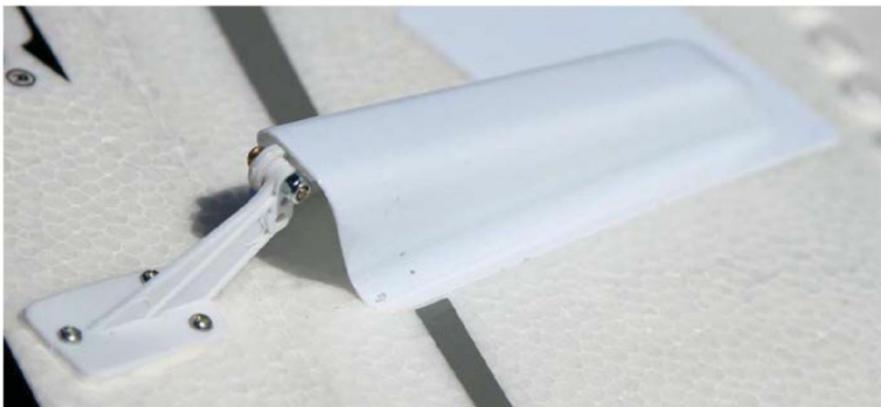
10 brushless motor and 40-amp speed control (installed)

PROP

E-flite 3S 2200 mAh LiPo

BATTERY

E-flite 3S 2200 mAh LiPo



Covered servos and linkages really help streamline the airframe.



The PNP version comes with a AS3X-enabled AR636 receiver installed and ready for flight.



The preinstalled folding propeller is ideal with the included power system. Note the air vents on the spinner—a nice touch.



A 3S 2200mAh battery provides low wing loading and plenty of flight time (up to 30 minutes!).

well, and I never felt as if it were lacking control. The integrated vortex generators really do their job.

Tracking: Being a blended-wing model with zero tail moment, the Opterra is not designed to track like a pattern plane. The set of vertical fins near the fuse and the winglets do a great job of minimizing yaw drift, and this is probably one of the best flying-wing designs I have ever flown. The Opterra goes where you want it and requires little input, especially with the AS3X engaged.

Aerobatics: I performed some loops, rolls, vertical figure-8s, and inverted flight, and all were fairly effortless.

Glide and stall performance: I must say that I am not even sure the Opterra will stall. Even with the motor off and flying at a walking pace, the Opterra just keeps floating along with what is perceived as zero sink. We have a small hill on final approach at my field, and after cutting the motor on the downwind leg and staying less than 5 feet off the hill, the Opterra still glided the entire length of the 800-foot runway, only for me to power up and go around. Its glide and stall performance are exceptional.

PILOT DEBRIEFING

What a fun plane to fly. It's large and easy to see, and it's stable and controlled at all speeds—it's just plain fun. One thing I would like to mention is the launch of the Opterra: I don't like launching a pusher plane with the motor running, and with the Opterra, it really isn't necessary. With SAFE

mode engaged, I gave the Opterra a firm toss and applied the power after it left my hand, and it displayed very little sink and I had no fear of it hitting the ground.



BOTTOM LINE

You can easily get the Opterra airborne in 15 minutes, and flying the Opterra is just as easy. My recommendation? Get an Opterra, take it to the field, and have a blast. +

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REALFLIGHT® experience

InterLink-X Controller by TACTIC

Wireless Interface Wired Interface Software

See realflight.com for information and complete system requirements.

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Venom Chargers



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NEW!

PHOENIX MODEL®

1:4 3/4 Spitfire
Wingspan: 95 in

1:4 3/4 Westland Lysander
Wingspan: 126 in

Giant!

Giant!

Giant!

NEW!

Piper J-3 Cub
Wingspan: 90.5 in

1:9 1/4 A-26 Invader Twin
Wingspan: 90.5 in

NEW!

NEW!

NEW!

MX2 120mm EP ARF Green
Wingspan: 47.2 in

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NEW!

Ryan STA
Wingspan: 53 in

Uproar V2
Wingspan: 47.6 in

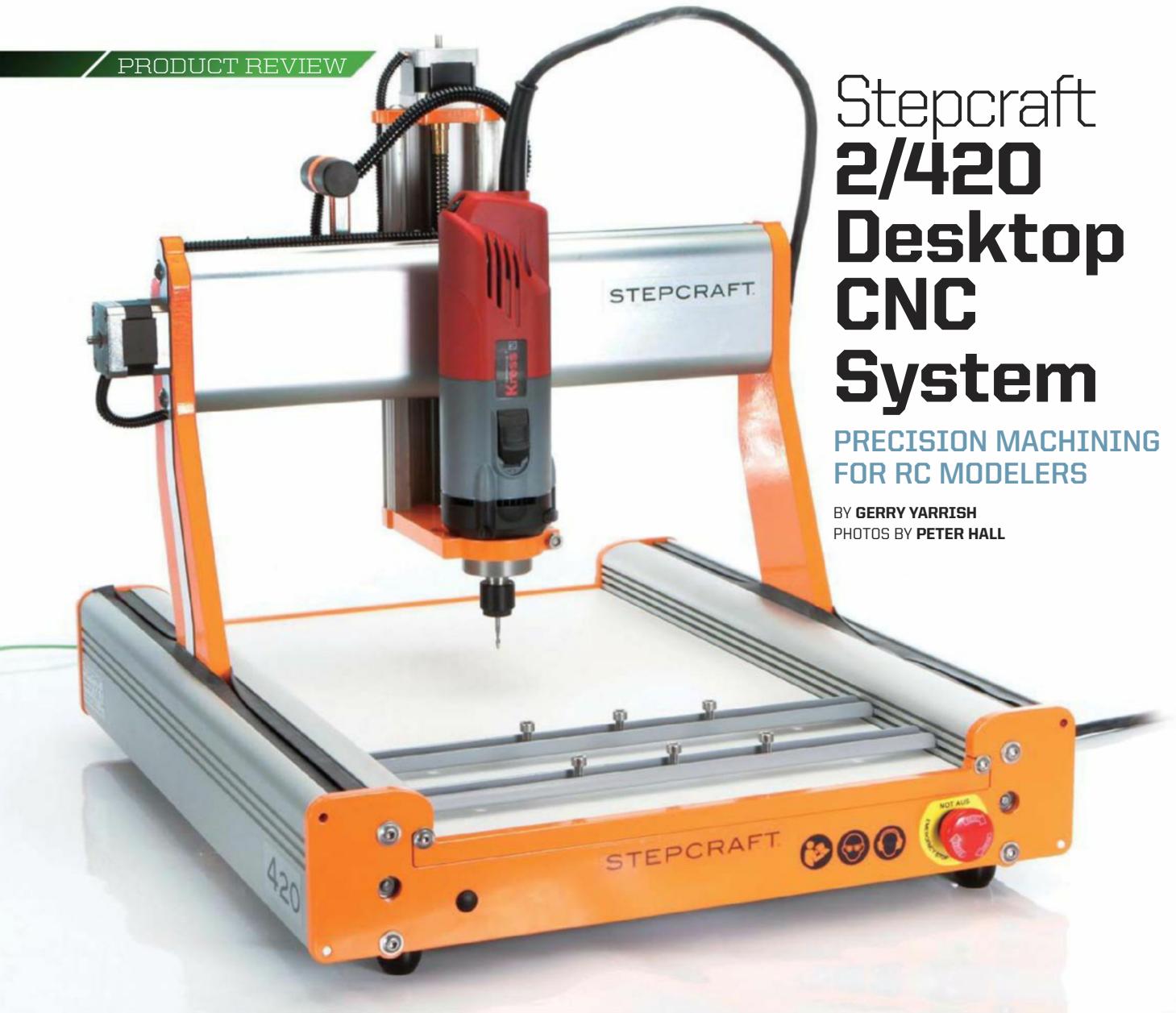
Sport
Wingspan: 60 in

ME1026 Uproar V2 GP/EP ARF 47.6" **2 PAY 50.00** \$99.99
ME1027 Ryan STA EP ARF 53" **NEW! 3 PAY 46.67** 139.99
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Stepcraft 2/420 Desktop CNC System

PRECISION MACHINING FOR RC MODELERS

BY GERRY YARRISH
PHOTOS BY PETER HALL



With a footprint of just under 22x18 inches, the new Stepcraft-2/420 desktop CNC system is ideal for modelers looking for the ultimate in utility. Well suited to producing all sorts of high-quality model-aircraft parts with the highest tolerances, the 2/420 and its optional accessories are perfect for making parts out of wood (balsa, light ply, plywood, and other hardwoods) or plastics and foam (polystyrene, Styrofoam, EPS, Depron, Selitron, ABS,

polyethylene, polypropylene [EPP], PVC, Lexan, polyamide, and Plexiglas) as well as fiberglass and carbon-fiber sheet material. It is also perfectly suited for machining nonferrous metals, like aluminum, brass, and copper.

But what makes this desktop CNC system all the more attractive is that it is available as a DIY kit, which you can assemble yourself for substantial savings compared to the factory-assembled model. Let's take a closer look.

UNIQUE FEATURES

Made out of high-quality German-made parts and hardware, the 2/420 comes in one well-packaged box. All the parts and pieces required except for the spindle (power head) are included. Being a 3D milling machine, the system includes all the moving parts for the X-, Y-, and Z-axis gantries, including stepping motors, lead screws, and precision-machined tracks made from extruded aluminum channel. All the hardware is top-notch and includes the screws, nuts, washers, bearings, bushings,



The entire Stepcraft kit comes in one well-packaged box, which contains everything except the spindle power head.

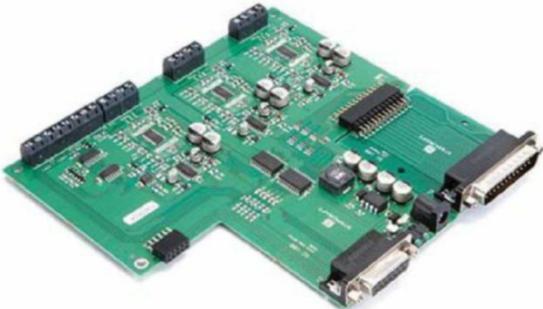
and track rollers. The frame panels, gantry uprights, and the end plates are all made out of thick, powdered-coated aluminum, and all the fastener holes come machined into the parts. All the electronics, including the main control circuit board, limit switches, and wire harnesses, are also part of the package. The main work surface is made out of 3/8-inch laminated medium-density fiberboard (MDF), which slides easily into place for quick replacement. All Stepcraft CNC systems come with the required CNCdrive motion-control program



The roller tracks are from precision channel made out of extruded aluminum.



There are three DC stepping motors, one for each axis of control motion. Here is the Z-axis motor and its attachment plate.



The main control board simply screws into place. All the motor-drive wires and the wire harnesses for the limit switches and the emergency stop button are easily attached using the connector buses.

on a CD as well as a well-illustrated assembly manual. The manual shows every step in detail and calls out all the required parts and hardware for each task. Stepcraft also provides online assembly tutorial videos. Combining all this with the company's excellent Connecticut-based customer service makes it easy putting together one of the DIY kits. I built the 2/420 desktop CNC system in about 8 to 10 hours while taking photos along the way.

GETTING STARTED

The tools required to assemble the system are

SPECIFICATIONS

Product: 2/420 Desktop CNC System
Distributor: Stepcraft (stepcraft.us)
Overall size: 21.65 x 16.93 x 20.08 in.
Weight: 33.07 lb.
Input voltage (AC): 100-240V
Output voltage (DC): 30V
Power consumption: 90W
Software: UCCNC (included), WinPC-NC (optional), Mach3/4 (optional)
Price: \$1,499.00 (kit); \$1,998.00 (ready-to-run)

HIGHLIGHTS

- ⊕ High-quality German-made hardware
- ⊕ User-friendly instructions and video tutorials
- ⊕ Easy to assemble and set up

an 8mm and a 10mm box-end wrench, a metric scale ruler for measuring the hardware, a set of metric Allen wrenches (flat and ball-end), long-nose pliers, a pair of scissors, electrical tape, and a tape measure. I recommend using an egg carton to organize the various screws and fasteners.

The first thing to do is to read the instructions and watch all the video lessons. Then while assembling the CNC system, have both the instructions and your laptop close at hand for guidance. You can easily do all the assembly tasks at your kitchen table or a small workbench. Adequate overhead lighting is a must.

ASSEMBLY

Go over all the parts and hardware, checking to make sure you have everything required. All the parts are identified in the first six pages of the instructions. The first item to be built is the X-Z connector plate. This part rides back and forth along the X-axis gantry linear track and supports the vertical Z-axis track. The connector plate supports the limit switches, contact plates, lead screw nuts, and rollers for both the X and Z gantry tracks. Once all the parts are installed, attach the wiring harness (which fits into a channel machined into the plate), then align the lead screw nuts to center the lead screw play.

Assemble the Z motor, bushing, axis connector, and the lead screw, then attach the motor to the top end plate. Fit the connector plate to the Z-axis track. This step is fully explained in the instructions, and the online videos show in great



The first part to be assembled is the X-Z connector plate. You can see that the limit switches, track rollers, and the lead screw nuts have all been installed.



This shows the Z-axis motor, lead screw, and track ready to be assembled.

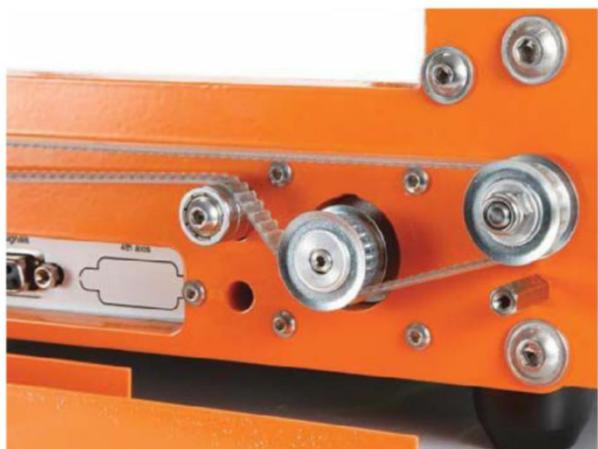
detail how to adjust the rollers so that they ride precisely on the vertical track; an Allen wrench is used to adjust the rollers for the proper amount of tension and eliminate any side play. Attach the Z-axis stepping motor, end plate, and tool-holder bracket to the vertical Z-axis track; this requires threading the lead screw through the lead screw nut. Insert the end of the lead screw into the bearing in the tool holder. Make sure all the attachment screws are snug.

Install the X motor and lead screw, then attach the rollers and lead screw nuts to the base of the two gantry uprights. Fit the uprights to the Y-axis linear tracks, and adjust the roller tension in the same way as done with the connector plate. Thread the two Y-axis lead screws through the lead screw nuts so that they can be aligned and centered, then attach the X-axis track to the top of the two uprights. Install the X motor, end bearing, and lead screw. Run the motor wires down in the channel machined in the upright, and install the protective plastic wire cover.

Assemble the Y-axis motor and drive pulley and prep the end switch so that they can be installed in the rear panel of the base frame.



The side panels on the system are hinged so that you can open them for cleaning and to grease the two Y-axis lead screws.



This shows (left to right) the Y-axis drive pulley, the Y-axis motor-drive pulley, and the idler bearing used to adjust the belt tension.

SPINDLE CHOICES

Shown on the Stepcraft website, there are several choices for spindles that you can order with the 2/420 system. For this review, I chose the Kress 800W spindle. Priced at \$309.00, the Kress 800 FME is a milling and grinding motor, with full-wave electronics providing consistent power and speed control. It has a soft start-up and start-current limitation, carbon brushes, and a stainless-steel motor flange with dual bearing for high-speed milling performance. Other spindle choices are the Dremel 4000, DeWalt DWP611 Trim Router, and the 500-watt DC-powered HF-Spindle with control unit. Stepcraft will provide the proper tool-holder bracket for each spindle you order.

Here, the Kress spindle is in place, ready for me to make my first cut. It has a variable-speed switch that needs to be set for the specific material being cut.



Again, the instructions and online videos go into great detail about how all the parts fit together.

FINAL ASSEMBLY

Once the front and rear panels, the two Y-axis tracks, and the bottom plates are all assembled, fit the completed gantries and uprights assembly into place on the side tracks, and thread the two Y-axis lead screws into place. Install the bearings in the front and rear panels, then attach the drive

pulleys to the ends of the lead screws. Attach the idler bearing and the other hardware items to the rear panel.

To properly align the two gantry uprights, move them all the way back to the rear panel by turning the two Y-axis lead screws. The easiest way to do this is to temporarily install the drive belt and use it to simultaneously turn the two drive pulleys; once the uprights are close to the rear panel, remove the belt and then turn each drive pulley by hand until each of the uprights just touches the rear panel. Install the drive belt as shown in the instructions, adjust the belt tension with the idler bearings, and install the belt cover on the back panel.

Thread the rest of the wiring and its protective cover tubes into place, and connect the wire leads to the emergency stop switch and the rear limit switch. Install the main control board and label panel. Install the rubber feet, and slide the MDF work-surface board into



Here you see the rear panel with the belt guard removed, showing the entire drive-belt setup. Under the belt is the panel where you attach the power leads and the computer USB attachment cable.



Here's the 2-420 and my laptop. It ran perfectly the very first time.

place and secure it. Connect the wiring to the control board using the attachment bus connectors. Neatly bundle the wiring and secure it with some electrical tape, and screw the removable bottom-access plate into place.

Except for assembling the job hold-down bars and adding the decals, the assembly of the CNC desktop system is now complete.

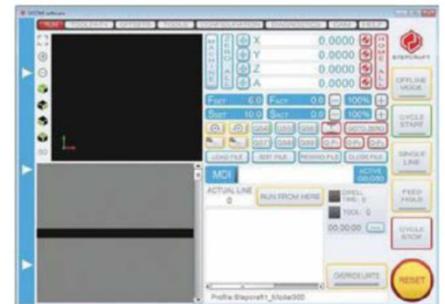
TESTING AND ALIGNMENT

It is important to apply the included machine grease to all the moving parts before you run the CNC system. Using an old toothbrush, apply a liberal amount to the length of all the lead screws and to all the track surfaces the rollers come in contact with. When it comes time to run the system, you need to test the performance of the motors and the lead screws. This is done by using the drive program to zero all the motors and gantries. Should the motors or lead screws jam and stop, simply

loosen the end plates to allow the lead screws, motors, and bearings to find their own natural alignment. Once you can drive the gantry to its full zero position, snug the attachment screws and then move the gantry to its other extreme travel limit and tighten those screws. Do this for all three axes of movement. With everything moving smoothly without any binding, you are ready to run.

CONTROL PROGRAMMING

The StepCraft CNC comes with a CD containing the UCCNC drive-control software, and this has to be installed in your computer. Once the program is running, connect the CNC to your computer with the USB cord and power up the system. When you launch the program, it will ask which CNC system you are using, and it will then load all its specific perimeters so that the program can control the system properly. Once this is done, use a program to



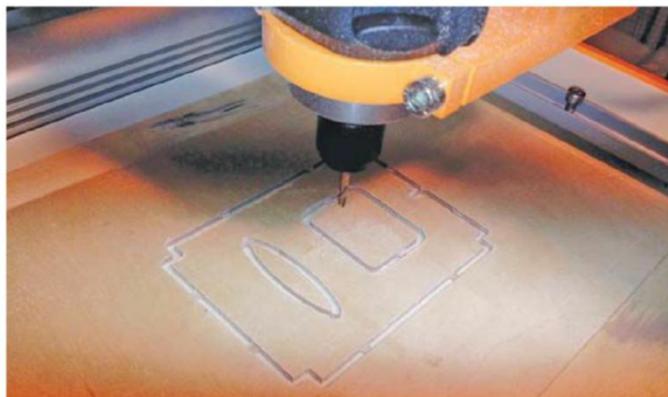
This is the UCCNC program dashboard used to control the CNC system. The tool path preview is at the upper left corner.

convert your CAD files into a G-code file that the CNC system can understand. For this review, I used the VCarve Pro program, which I found easy to use.

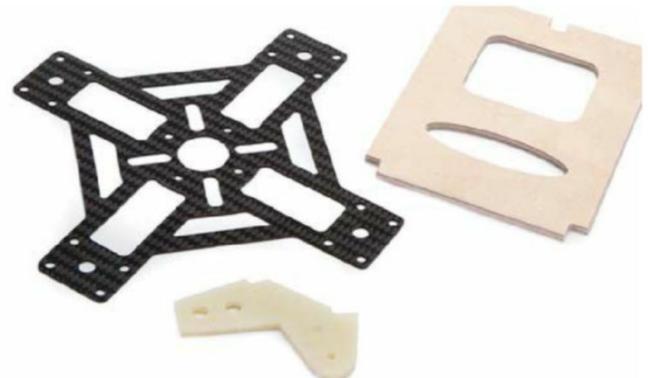
Each time you want to run a job, connect the CNC to your computer, power it up, and launch the UCCNC driver program. Place your workpiece and a spoiler board under it, and clamp them into position. Load the G-code job file and zero the X-, Y-, and Z-axis gantries with the "Zero All" function. Manually move the spindle to the required position (using the arrow-direction controls) over your workpiece. Install a milling bit in the spindle, and lower the Z axis until the bit just touches the top of your workpiece. Manually assign the new job zero points for all axes when you see the yellow dot appear in the tool-path preview screen. Switch on the spindle motor and you're ready to go. For more photos and details, go to ModelAirplaneNews.com/stepcraft.

BOTTOM LINE

I found the StepCraft-2 420 desktop CNC system easy to assemble and set up. The required programs are either included with the kit or are available from StepCraft. If you are comfortable with assembling and operating precision equipment and can understand the basics of computer programs, you'll find the 2/420 CNC three-axis milling system a wonderful addition to your modeling workshop. \ddagger



The first test cut was done with 1/8-inch plywood. Notice the spoil board placed under the workpiece.



Here are three test jobs I ran using 1/64-inch carbon fiber, 1/8-inch plywood, and 1/8-inch G-10 fiberglass.

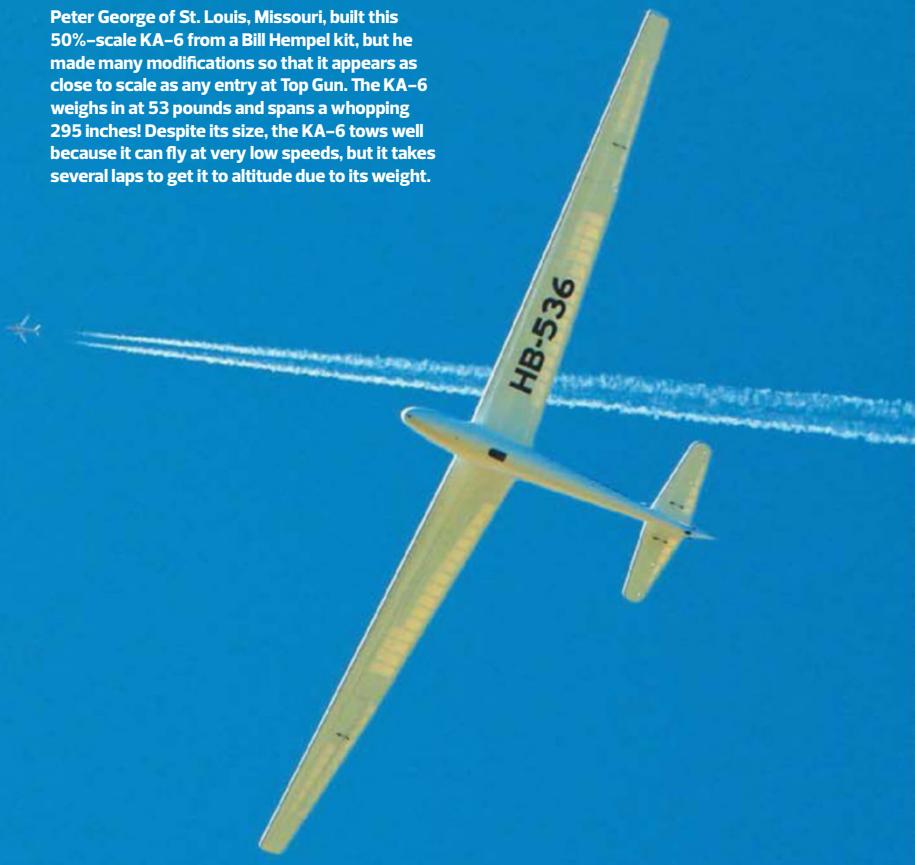
RC AERO

Try a new way to get airborne!

BY ANDREW GRIFFITH

If you're looking for something different to try, consider RC aerotowing. Aero-towing (using a towline so that a larger plane can haul a glider to altitude) is a growing aspect of the sport due in part to a number of manufacturers offering both gliders and towplanes equipped to do the job. That takes out some of the guesswork, and I hope my advice in this article will take care of the rest.

Peter George of St. Louis, Missouri, built this 50%-scale KA-6 from a Bill Hempel kit, but he made many modifications so that it appears as close to scale as any entry at Top Gun. The KA-6 weighs in at 53 pounds and spans a whopping 295 inches! Despite its size, the KA-6 tows well because it can fly at very low speeds, but it takes several laps to get it to altitude due to its weight.



TOWING



Len Buffinton shows off his Paritech DG1000, which spans 9 meters, at the Southeast Regional Aero Tow.



The Hangar 9 33% Pawnee is a popular towplane and was in almost continuous use at the Horizon Hobby AeroTow.

WHAT DO YOU NEED?

The most obvious answer is a towplane and a tow-release-equipped glider. You also need two willing (and hopefully) experienced pilots and a towline. Good tow pilots can often coach inexperienced glider pilots through their initial tow flights, but first-time tow pilots should already be confident flying the plane they intend to tow with and would ideally tow experienced glider pilots. Like many other things in aviation, towing isn't that difficult, but reacting well when there's a problem could be the difference between setting up another try and two crashed planes.

SETTING UP A TOWPLANE

Glider towplanes come in many shapes and sizes, but they all have a few things in common. First, they should be equipped with a tow release. I've heard some say this isn't needed, but tow pilots should be able to release the towline and glider in case of any issues. As a tow pilot, I have only had to drop the towline a few times, but each time, it saved the towplane. The cardinal rule, especially at an aerotow event, is to save the towplane!

The tow release should be located near the tow plane's center of gravity. Towing from the tail works for full scale but can create problems for RC models. The closer the towline is mounted to the tail of the tug, the more effect the attitude of the glider can have on its pitch. If the glider gets too high, it will pull the tail of the towplane up, forcing the nose down. If this happens right after takeoff, you can picture the results. The opposite is just as bad: Get too low and the tail is dragged down, and the towplane could stall. Mounting the tow release on top of the fuselage at the rear of the wing saddle works well for most high-wing designs, and mounting it at the rear of the cockpit works well for low-wing planes.

Tow-release mechanisms are available from several sources, or you can fabricate something yourself. Some models, like the E-flite Carbon-Z Cub, come equipped with a tow hitch that you can activate by installing an optional servo. Small towplanes that pull up foam gliders can get away with a simple release, but I've modified larger gas planes for tow duty that required adding a supporting structure to reinforce the tow-point area as well as using a

heavy-duty machined tow release and high-torque servo.

The towplane needs sufficient power to fly itself with authority because it's taking on the weight of the glider it will be towing. The Carbon-Z Cub, in our example, would be well suited to 2m and some 3m gliders but would struggle with larger and heavier models. The closer you get to the critical weight, where it becomes unsafe to tow, the more experienced tow pilots need to be so that they can adjust the climb rate and turn radius so the glider doesn't stall.

In addition to the power required to haul the weight of the glider, the speed of the glider must also be considered. I have a vintage K-8 that can be towed up by almost anything with enough power to pull a 10-pound glider because its stall speed is insanely slow. High speeds on a glider like this could even lead to airframe failure. Modern "glass slipper" gliders with high-aspect-ratio (long and skinny) wings must maintain their airspeed to avoid stalling, so tow pilots would need a shallower climb rate to keep the speed up.



The World Models Cherokee has an extremely simple external tow release. I bring one of these models to our events for any RC pilot who wants to try aerotowing.



My SebArt 3.3m Blanik glider came equipped with this fancy internal tow-release mechanism.



Here, you see a heavy-duty machined-aluminum tow release with a hardened steel pin mounted right behind the over-wing hatch.

Pilots should stand next to each other and communicate during the tow. Communication is easy when you're husband and wife. Here, Pete Goldsmith tows up the glider of his wife, Caroline, at the Horizon Hobby AeroTow event.





My towline uses a mason's line, a nylon flag, fishing-line swivels, and (of course) a birdie.



Fishing-line swivels keep the line from balling up and making a mess.

SETTING UP THE GLIDER

Almost any glider can be set up for aerotowing, even those equipped with electric motors. The best results are obtained when towing gliders equipped with ailerons. Rudder-only gliders can be towed, but polyhedral-wing designs tend to start oscillating on tow when the speed builds, and that can get ugly in a hurry if glider pilots don't release immediately.

A variety of purpose-built tow releases are available from several sources, and some gliders (mostly scale) even come equipped for aerotowing. The good news is that you don't need anything fancy: A servo-activated steel pin going through a block of hardwood is usually sufficient. While some tow releases go through the center of the nose, placing a tow release anywhere up front, even a few inches back on the bottom, works fine.

THE TOWLINE

Strangely, this subject often stirs debate, but I'll tell you what has worked for me. Better than 90 percent of the aerotowing I do is with planes between 2 pounds and 25 pounds—that is to say, smaller foam models, such as the Multiplex Easy Glider, up to my 24-pound 4.2m E-flite Blanik. The towline I most frequently use is a #18 braided mason's line in an eye-catching dayglow pink or yellow. Line length varies from 50 feet for the small gliders to 100 feet for the larger models. Heavy-duty gliders, such as those often seen at events and gatherings, require not only a large towplane but also a heavy-duty braided nylon seine towline and heavy-duty fittings. The towline is equipped with fishing-line swivels at either end so that it doesn't get twisted up (they also provide a convenient attachment to the towplane or on the tow loop on the glider end). A few feet from

the glider end of the towline is some sort of flag so that you can see the towline pull away from the glider when glider pilots release the line. It's important to know you have clean separation as most experienced tug pilots make a dive for the runway after release, and you don't want the glider hanging on when this happens. Also at the end of the line, a badminton birdie provides enough drag to keep the line straight behind the towplane and helps keep it from becoming snagged on trees and fences.

A "tow loop" is a piece of towline that connects the tow release on the glider to the snap swivel on the end of the towline. At fast-moving events, glider pilots grab a tow loop, arm their radio, and attach the tow loop to the glider. When the towplane lands, helpers will remove the tow loop that was left on the line, attach the swivel to the next glider, and send you off as the next people are preparing their glider.



Michael Kelly from Taylorsville, Kentucky, loves unusual scratch-built creations. Here is his 1932 BS2 Balestruccio, which is true to the original plans and spans 118 inches. Care must be taken by the tow pilot to keep the speed down when towing a model like this.



The Piper Pawnee is a popular towplane for both models and full-scale gliders.

At events such as the Horizon Hobby AeroTow or the Southeast Regional Aero Tow, there are often two towplanes in operation at the same time to prevent long wait times. That is when the pattern gets busy, so a wide runway helps tremendously!

FLYING THE TOW

If you have everything you need, all that is left is the tow flight. Ideally, glider pilots and tow pilots will stand next to each other for good communication. Tow pilots should verify that the towline is laying on top of the vertical stabilizer, and glider pilots should do a quick control check. When everything is ready, tug pilots will advance the power smoothly, and glider pilots should announce that they are airborne. This is the most dangerous part of the tow because tow pilots usually can't see both models and any problems occur in perilous vicinity to the ground. Once you clear 200 feet, you have breathing room and an emergency release results in a short glider flight and not a mishap.

Glider pilots should follow any call to release without question. Save the planes first; discuss what happened and how to prevent it when everyone is safely back on the ground. Tow pilots should do their best to accommodate requests for more speed or more climb rate by adjusting the throttle or elevator as needed. The closer the glider is to the maximum capability of the towplane, the flatter the tow will need to be, and more turns will be required to obtain sufficient altitude. Make sweeping turns to avoid stalling either plane.

Glider pilots should know when to say



The 4m Flair K-8 is popular at aerotow events. The K-8s of (left to right) Craig Williams, Steve Betts, and me are lined up for aerotowing at a club picnic and fly-in. Craig's is finished in the scheme of the full-scale K-8 that he owns and operates.

"When!" You want a good launch for sufficient height and enough time to find lift, but I have seen glider pilots hanging on until the towplane is barely visible. Give the tow pilots and the next people in line a break, and take on some of the work yourself; after all, that is half the fun!

TOWPLANES

Piper Cubs and Pawnees, Super Cubs, Pilatus Porters, and Telemasters all make good towplanes. Topmodel makes the Miss Tractor and Bidule, which are purpose-built towplanes. If it has plenty of power and a suitable location for a tow point, it will probably make a good towplane.

AEROTOW GLIDERS

I'm often asked which glider to start with, and the answer depends on your budget. The E-flite K-8 and the Multiplex Easy Glider or Heron all make inexpensive training gliders. A step up

from that is the built-up Hall Cherokee and K-8 from Phoenix Model. At the next level in expense, performance, and complexity are the E-flite Blanik and the Hangar 9 ASW 20.

THE TAKEAWAY

In closing, it's important to note that both glider pilots and tug pilots should be able to release the towline and that the towplane should have plenty of power and be propped for good pull. Of course, good communication between glider pilots and tug pilots is the key to success. Towing is great fun and adds a new dimension to your flying; it takes practice and skill and is a satisfying accomplishment. Find and get to an aerotow event as the people involved are all about growing the sport and helping in any way they can to ensure your success. +

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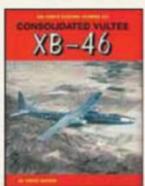
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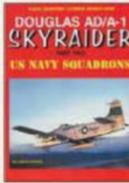
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HOW TO

Break In Your Engine

GET TOP PERFORMANCE FROM YOUR TWO-STROKE ENGINE

TEXT & PHOTOS BY GERRY YARRISH

Used in the RC hobby for decades, two-stroke glow engines provide a good power-to-weight ratio, have relatively few moving parts, and are fairly inexpensive. The care and feeding of your glow engine is very simple. When properly broken in, a two-stroke glow engine will last for many years. For the most part, the .25- to .60-displacement range remains popular, and there are countless trainers and sport planes designed to use these engines for power. But for the engine to produce its rated power output, it first has to be properly broken in. Let's take a closer look at how your two-stroke engine operates and then we'll go over proper engine break-in.



The tools needed for breaking in a two-stroke engine are a glow-plug wrench, a glow-plug driver, a common screwdriver, and long-nose pliers.

All set up for breaking in the engine, the Phoenix Sonic, powered by an O.S. .25 FX, is secured in place on a portable table to keep it up off the ground. This keeps everything clean and away from any debris that could get caught up in the propeller. Byron Aero Gen2 fuel and a Sullivan Dynatron electric starter are also shown.



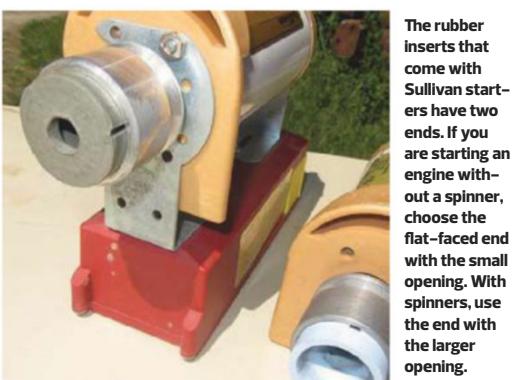
To get the engine started, I used the O.S. #8 glow plug supplied with the engine. If your engine does not come with one, a good source is Swanson Associates, which distributes Fireball glow plugs. Shown here are the Standard and the RC Idle Bar types.



To fill and drain your fuel tank, use a good-quality pump, like this TY1 from Icare-Icarus. Also use an inline fuel filter.



Make sure to properly install your engine and attach a balanced propeller to minimize vibration. In place of a plastic spinner, I like to use an aluminum safety nut like this one from Tru-Turn.



The rubber inserts that come with Sullivan starters have two ends. If you are starting an engine without a spinner, choose the flat-faced end with the small opening. With spinners, use the end with the larger opening.



To secure my airplane to the test table, I used a bungee cord and looped it over the main gear. This keeps the airplane from moving even at full power, and it prevents the airplane from moving sideways.



INSTALL AN ONBOARD GLOW DRIVER

If you want to add a little convenience and increased flight reliability, you can install an onboard glow driver, like this one from Crain Engineering. It can be set to come on and off depending on the position of your throttle stick. An onboard glow driver keeps the glow plug lit at low-throttle settings, such as during final approach. It also makes it easier to start your engine without a separate glow driver attached to the engine. craineng.net



The carburetor should move smoothly and completely with the full travel of the throttle stick. Top: The throttle is fully closed. Above: This shows the carburetor completely open for full throttle.

SETTING UP

Although today's engines are of excellent quality, it's usually a good idea to remove the backplate and look inside the crankcase for metal shavings or other foreign debris. Remove the head and check the combustion chamber for the same thing. Squirt some 3-in-1 oil into the engine, and turn the engine over. Lubricate the bearings as well as the con-rod bushings.

Reassemble the engine, and tighten the screws in a crisscross pattern. Do not use thread-locking compounds on any of the engine screws or bolts. It's not required and will only make future maintenance difficult. You might even strip out the threads.

Never force anything that won't move easily. Most of the engine is made out of aluminum, and it is very easy to damage the threads. Always use the proper-size wrench to tighten the prop nut; never use vise grips or pliers. A 6-inch adjustable wrench is a good tool for this.

Before actually getting into the breaking in part, you have to set up your model and gather

the needed equipment. I like using a table to support the model so it is up at a convenient height and off the ground so you don't get anything inside the carburetor. I use a bungee cord to secure the model's landing gear to the table. The equipment needed is an electric starter, a glow driver and a spare glow plug, a fuel pump to transfer fuel from the container to the model's tank, and later to drain the tank when you are done. Also needed are basic tools to adjust the low-end needle valve, tighten the prop nut and install, and tighten the glow plug.

ENGINE BREAK-IN

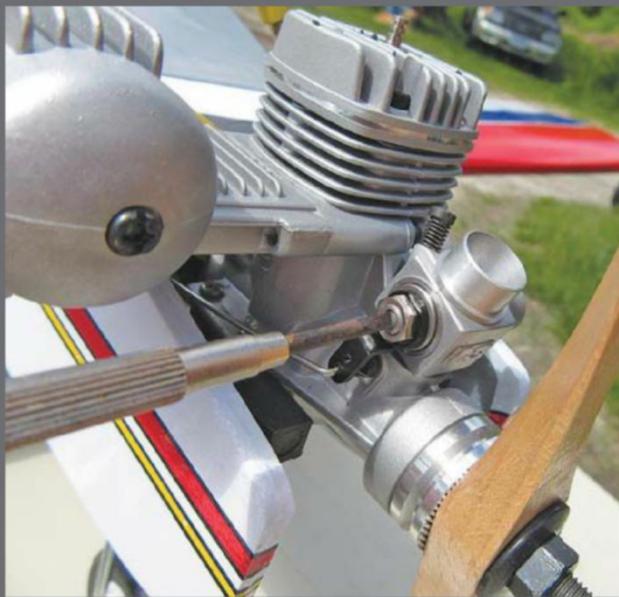
A brand-new, out-of-the-box engine requires special handling before it can be run at full throttle. Don't just bolt it to your model and go out to the flying field. Play it safe and break in your engine at home, where you have all your tools and supplies. To be specific, breaking in an engine is the gradual wearing and fitting together of the engine's internal parts by short, well-lubricated runs.

Install a new glow plug as recommended by the engine manufacturer. Fill the fuel

HOW TO BREAK IN YOUR ENGINE



Here is the main (top-end) adjustment needle valve. For safety, make adjustments from behind the propeller.



The idle (low-end) needle valve is adjusted with a screwdriver. It is at the center of the engine's throttle arm and should be adjusted only when the engine is not running.

SETTING THE NEEDLES

To properly set the fuel mixtures, start with the settings that come with the engine. The low-end mixture will usually be adjusted pretty close to the correct setting at the factory. Start the engine, and bring it to an idle. If it dies abruptly when you open the throttle, the low-end setting is probably too lean; you'll have to increase the amount of idle fuel draw. If the engine settles into an idle but then bubbles and dies when the throttle is opened again, then the low-end setting is too rich and the idle mixture has to be leaned out. Make adjustments in small increments. When the needle valves are set properly, your engine will have a nice reliable idle and it will transition smoothly to full power when the throttle is advanced.

For all types and brands of RC engines, it is always preferable to follow the engine manufacturer's operating manual. And make sure the engine has a reliable idle before becoming airborne.



To start the engine, place the starter's insert over the prop nut and hold the starter in line with the engine shaft. Engage the starter, and when the engine fires up, simply pull the starter back free of the engine.

tank with two-stroke fuel that has about 5–10% nitro and 18–20% oil. Attach the fuel line to the carburetor, making sure that it's not kinked or resting against the engine; it's going to get really hot as the engine runs. Install the recommended propeller, then install the washer and prop nut, and tighten.

Open the engine's main needle valve at least four full turns, and open the carburetor fully. Place your thumb over the intake, and flip the prop several times counterclockwise until you see fuel flow into the carburetor. Close the throttle to about 1/4, and hook up the glow-plug-driver battery. For additional safety, flip the prop over with a chicken stick or an electric starter until the engine starts running.

Open the throttle up all the way, and let the engine run in a very rich, low-power



Before starting the engine, check your glow driver to ensure that it has a full charge. Use a spare glow plug to make sure you brightly light the element.



Also check to ensure that, when it is attached to the glow plug in your engine, the meter reads in the green.



After several tanks of fuel (this engine took four), your engine should have a smooth transition from idle to full power. Be patient, and make needle-valve adjustments in small increments.



TYPICAL PROPELLER SIZES

(vary by engine and propeller brands)

Engine displacement	Propeller range
.25	8x5 to 9x6
.40	10x5 to 11x6
.60	11x5 to 12x8
.75	12x6 to 13x8
.90	13x6 to 15x6
1.20	14x8 to 16x6

setting. After about 10 minutes, stop the engine and let it cool off. Repeat the process several times while gradually leaning out the engine by a couple of clicks of the main (high-end) needle valve for each run. Don't let the engine run at a high rpm until you have about four or five tanks of fuel run through the engine.

You are trying to wear the internal parts of the engine gradually so that they match one another precisely. We are most concerned about the piston and sleeve fit. Some engines break in more quickly than others, but to operate properly and produce maximum power, all engines must be broken in. If you run an engine without breaking it in first, the engine will get very hot because of excess friction, and the localized heat can cause damage to the engine.

You will know your engine is properly broken in when it starts to run consistently without overheating and it has a smooth transition from idle to full power. A good rule to follow here is to operate your engine a few clicks on the rich side rather than a few clicks on the lean side.

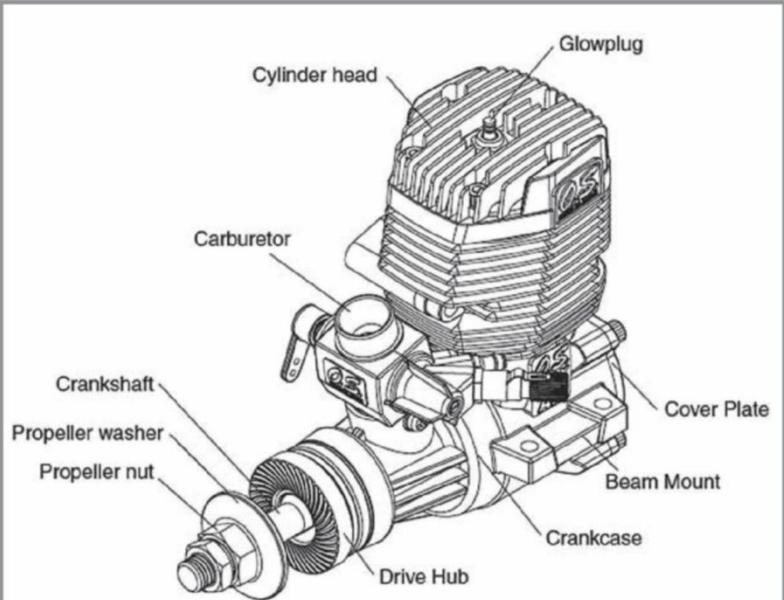
ENGINE MAINTENANCE

Proper care from the start will ensure maximum power and longevity from your engine. Start taking care of your engine the day you bring it home. Most engines come with tools to tighten and loosen the engine screws. Keep these in a safe place, and if you lose them, replace the tools with new ones of the proper size.

AFTER RUN

After the last flight of the day, drain all the fuel from the tank and run the engine dry of fuel. Then squirt in some after-run oil to coat the inside surfaces of the engine to prevent corrosion. Alcohol-based fuels attract moisture, and an unprotected engine will corrode, especially its ball bearings. Oil is inexpensive insurance to achieve long engine life.

Following these suggestions will keep your two-stroke engine happy and running as intended. A little effort in the beginning will reward you with a long-lasting, easy-to-start, and easy-to-run engine, and that's good for any type of airplane you fly. 



Engine Terminology

There are a few basic terms you should know to better understand your model-airplane engine:

- **Engine case.** The main body of the engine.
- **Head.** The part on top of the engine that is usually bolted in place. At its center is a threaded hole for the glow plug.
- **Sleeve.** The inside-cylinder lining that houses and guides the piston. It is a separate piece from the engine case and has openings or ports cut into its side. There are some engine designs that do not have a separate sleeve.
- **Ports.** Channels or openings inside the engine that guide and transfer the fuel-and-air mixture from the crankcase to the combustion chamber. The ports are opened and closed by the piston's up-and-down motion.
- **ABC.** The materials used in the engine. An ABC engine is one with an aluminum (A) piston, fitted inside a brass (B) sleeve that's been chrome (C) plated.
- **Con rod.** Short for "connecting rod." This part connects the piston to the crankshaft. The con rod has a bushing at either end and is connected to the piston with a wristpin and to the crankcase with the crankpin.

Engine Operation

A two-stroke engine makes two revolutions for every power cycle. As the piston moves up, it compresses a fresh fuel charge. The fuel and air mixture heats up and is ignited by the glow plug. The upward motion of the piston also creates a negative pressure within the crankcase below the piston, and this draws air and fuel in from the carburetor through the intake valve. The combustion of the fuel mixture forces the piston down during the combustion cycle, which now compresses the fresh charge of fuel. As the piston travels down and the hollow crankshaft rotates, the intake valve is closed and the intake ports open. The compressed fuel charge travels through the ports and is directed into the combustion chamber. This happens just as the previously spent fuel charge is exiting the combustion chamber through the exhaust port. As the piston starts moving up again, it closes the exhaust port and opens the intake valve, and the whole process starts all over again. This is the basic process for a front-intake engine design, which has the carburetor positioned in front of the cylinder.

Ultimate Electrics

TEXT & PHOTOS BY JOHN KAUK

DON'T TRASH YOUR LIPOS!

TIPS FOR SAFE, RESPONSIBLE BATTERY DISPOSAL

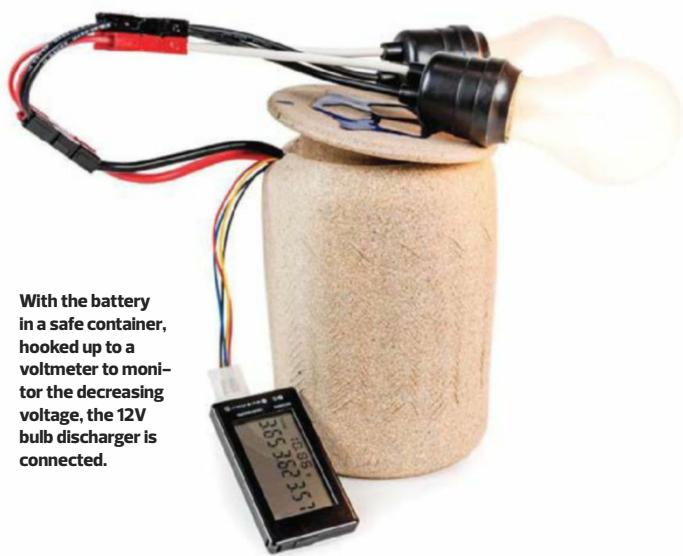


Chris Champion flies his Hangar 9 60cc F4U Corsair in a slow and dirty flyby at E Week 2016. Powered by an E-flite Power 360 motor on a 12S 13000mAh LiPo and a big Biela 3-blade propeller, it's an impressive sight and a good flier.

Lithium-polymer batteries (LiPos) have been a great boon to those of us involved in electric flight: They're lighter and more energy dense than the Ni-Cd and NiMH batteries we used in the past, and they're being used by more people all the time. But like all batteries, LiPos have a finite lifespan. Whether by way of crash damage, overcharge or overdischarge damage, or just plain old age, our batteries eventually come to an end of usefulness. When they do, they need to be disposed of responsibly. Before they can be disposed of, LiPos should be made as safe as possible so that they don't cause problems somewhere down the line.

DRAINING THE "JUICE"

The first part of this "decommissioning" process is to completely discharge the battery. In my July 2017 column, I wrote about making a battery discharger using a 12-volt lightbulb and a light socket. That simple discharger has become my go-to device to begin the battery-disposal process. Before starting the discharge, there are a few things to do. I take the battery out of the house or shop to an area that's well ventilated and away from other combustible materials. If the battery has been physically damaged or is badly puffed, it could be unstable and



With the battery in a safe container, hooked up to a voltmeter to monitor the decreasing voltage, the 12V bulb discharger is connected.

POWERHOUSE CHARGER

At just over 3 inches square, the ISDT Q6 Plus is a little powerhouse of a full-featured balancing charger. It's a multichemistry charger capable of charging batteries including Ni-Cd, NiMH, LiPo, LiFe, Li-Ion, and HV LiPo. With output power up to 300 watts and a charging current up to 14 amps, it can handle up to 6S LiPos in the larger capacities. Input power ranges from 7 to 32 volts.

The Q6 Plus has a beautiful full-color screen and is simple and intuitive to operate. A single click wheel scrolls and selects all menu options, which include balance charge, discharge, and storage programs. Power input and charging output are by way of XT60 connectors in the housing, so batteries using that popular connector style can be charged directly, with no adapter. Two XT60 plugs are included with the Q6 to make adapters for other types of connectors.

Available at hobby shops and online retailers for about \$60, the Q6 Plus is inexpensive and small enough to store in a transmitter or racing-quad case. So there's no need for you to ever be without a charger, wherever you are.



The ISDT Q6 Plus is a small but capable multi-chemistry charger. With maximum power of 300W and a maximum charging current of 14A, it's capable of working with battery capacities of all sizes.



After discharging using the bulb discharger, this battery was connected to a couple of meters. Within moments of removing the load, the voltage increased from near zero to 8.2 volts, and one cell got back to 3.2 volts. This is why it's recommended to completely discharge the battery in a saltwater solution.

start to burn. It's better to be cautious and prepared, so I keep a bucket of sand and a fire extinguisher nearby. The sand is for covering a burning LiPo, and the extinguisher is for anything else that may catch fire.

I put the battery to be discharged into a fireproof container with a lid. I have a ceramic battery bunker and a glass-topped ceramic baking dish from CorningWare that I use. I plug a battery checker into the balance tap to monitor the voltage, then plug one or two of the discharger bulbs into the battery leads. The bulbs get hot when lit, so again, this should be done in a safe location. After a while, the bulbs will bring the battery down to a very low, near-zero voltage and the lightbulb will go off. If you connect a meter to the power leads right after disconnecting the bulb discharger, you'll likely see the voltage rebound. After a few minutes, the voltage may have recovered to as much as 2.5 or 3 volts per cell, but there's not much power there. At this point, the battery may be at a low



This Pulse 6S 5000mAh battery weighs 27 ounces. It contains about 9 ounces of copper and almost 7 ounces of aluminum. Recycle!



This 3S LiPo is puffed from being discharged too deeply. One cell is also much lower in voltage than the other two and won't come back in line with careful balancing efforts. It's time to recycle it.

enough energy state to dispose of safely. But to be absolutely sure, I soak it in a concentrated solution of salt and water.

The solution is easy to make: Just add about a cup of regular table salt to a gallon of warm water. Since saltwater is electrically conductive, immersing the battery and its leads into it effectively shorts the battery and gently discharges it completely. It may take a day or two for the slow discharge to complete, so it's necessary to check the voltage occasionally to confirm that it's done. After that, I allow the battery to dry before disposing of it.

RECYCLING LIPOS

This is the part where a lot of people will say it's OK to simply put the dead battery into a trash can for disposal in the local landfill. And they would be right, generally speaking. It's perfectly safe to do so, but recycling is a much better option. It may take a little more effort, but I think it's the responsible thing to do, and here's one of the reasons why.

In a recent email conversation with friends on this topic, the question was asked, "Once and for all, is there anything in LiPos that makes it important or beneficial to recycle them?" Doug Ingraham, who designed chargers and speed controls for Astro Flight and has forgotten more about batteries than I'll ever know, responded to the question. He pointed out that, in a typical LiPo, about a third of the mass is copper and about a quarter of the mass is aluminum. A fairly small amount of the battery's mass is lithium, about 1 percent. So in a 6S 5000mAh LiPo that weighs 26 ounces, there's more than 8 ounces of copper and more than 6 ounces of aluminum. For me, that's what makes it worth the additional time and effort to recycle.

To recycle batteries, you shouldn't just toss them into your home recycling bin (although it seems that many people do). An article I read recently said that lithium-ion batteries are one of the leading causes of fires in recycling trucks. Hazards like that are easily avoided by disposing of batteries safely.

The first step in recycling LiPos is to locate a place that offers battery recycling. Quite a few retailers who sell tools and electronics containing lithium batteries will accept them for recycling. Best Buy, Home Depot, Lowe's, and Batteries Plus Bulbs are all stores in my area that come immediately to mind, and I'm sure there are others. In the county where I live, the Household Hazardous Waste unit will take all kinds of batteries for recycling, so it's worth checking into community recycling services if you don't live near a retail outlet that recycles.

For help in locating a recycler near you, there are several Internet resources you can check. Each of the following websites has a simple search function, which makes it easy to find the nearest location:

- energizer.com/responsibility/battery-recycling/where-to-recycle-batteries
- search.earth911.com
- call2recycle.org/locator

There are also recycling businesses that will send you a box you can use to send them batteries for recycling. All the ones I checked charge for their services and seem to be geared more toward business or industrial needs instead of the smaller-scale hobbyist, so they're probably not a good choice for us.

LIPo DISPOSAL SUMMARY

We use a lot of different lithium chemistry batteries today, and I think they're safer to use now than they were when they first became available. But like most things, they wear out and eventually stop performing well enough for continued use. When that happens, it's up to us to dispose of them safely and responsibly.

NEED HELP RECYCLING? SEARCH FOR A RECYCLING SOLUTION BELOW

SEARCH FOR

Lithium Batteries

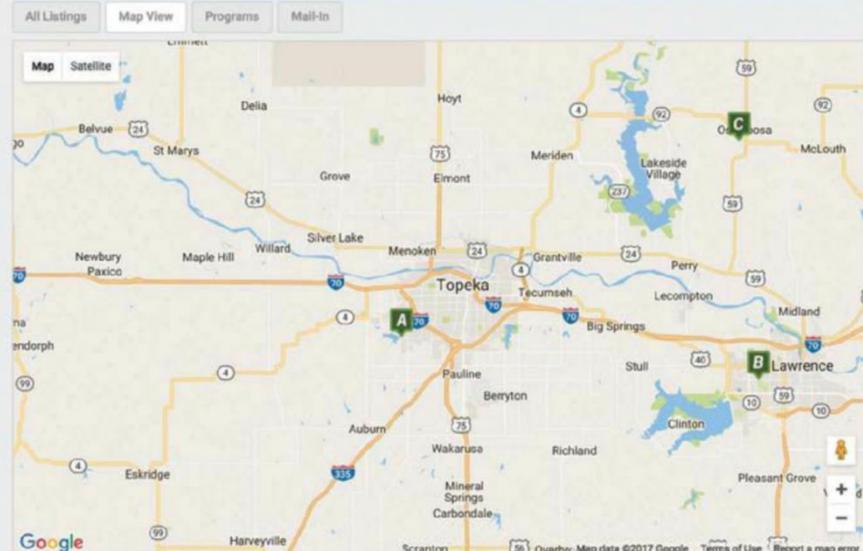
ZIP CODE

66604

SEARCH

Recycling centers for "Lithium Batteries" near "66604"

Within: 25 miles



A Batteries Plus Bulbs

(785) 228-9377
6021 SW 29th St
Topeka, KS 66614

3 mi. Location

B Batteries Plus Bulbs

(785) 312-9300
4651 W. 6th Street
Lawrence, KS 66049

23.7 mi. Location

C Jefferson County Household Hazardous Waste Drop-off Site

(785) 863-2581
300 Jefferson St
Oskaloosa, KS 66066

24.9 mi. Location

Choosing "Lithium Batteries" and entering a zip code near mine into the search fields at earth911.com resulted in three locations for recycling within 25 miles. The first result was the location to which I regularly take batteries.

- Do the final discharging in a safe, well-ventilated place.
- Be ready for the worst. Have sand and a fire extinguisher nearby, ready for use.
- Discharge the battery completely in a saltwater solution.
- Take the discharged battery to a recycler.
- As the last alternative, dispose of the completely discharged battery in a landfill.

FINAL THOUGHTS

LiPo batteries can last us a long time. Greg Gimlick, a former Ultimate Electrics columnist, told me recently about a seven-year-old LiPo that is still performing fairly well. That's a long time, and it may be more than most of us can hope for. But charging gently at a 1C rate, taking batteries down to about 3.8 volts per cell for storage, and not pushing them hard in use will help make them last as long as they can. When they're used up or damaged in spite of our best efforts, we need to dispose of them responsibly. †

Final Approach

BY GERRY YARRISH PHOTOS BY RICH URAVITCH



With a 63-inch span and an iron-on film finish, Rich's Tsunami 60 is a 60N-class turbine-powered sport jet that's easy-to-build and transportable. It is all-wood, includes nothing exotic, and is affordable!



Evolution of a Sport Jet From electric ducted fans to turbine power!

A prolific RC model airplane designer, builder, and pilot, Rich Uravitch has a long and involved history with *Model Airplane News* and has been a regular contributor for many years. The original "Jet Blast" columnist, Rich even served as our editor-in-chief for several years. The editors are always in contact with "Brother Rich" and we spend a lot of time talking RC.

Rich noticed early on the development of jet models and developed easy-to-build jet-model designs to help get the average builder into a design that would work well and not break the bank in the process. His first original-design sport jet was the 36-inch-span Microwave, an electric jet that was powered with an inexpensive 54mm ducted-fan unit and motor. Published in the January 2010 issue of *MAN*, the Microwave plans were a hot seller and went on to spur the development of other similar fan jet models. Not letting any moss grow on his fan units, Rich came out with a larger 48.2-inch-span version called the Tsunami-E, designed for 90mm fan units. It was big enough to easily include retracts and had a smoother overall flight performance.

Rich's newest iteration is the Tsunami 60, and it's a true turbine-powered jet. Like the earlier versions, it features all-wood construction,

The Tsunami 60 is the largest of the design trio, joining the 54mm EDF-powered Microwave (shown above) and the 90mm Miniwave/Tsunami-E (90mm electric jet), both published in *MAN*.

so, yes, it does require modeling skills and time! Off-the-shelf retracts from nearly any source will drop right into place, and a simple 6-channel radio is required. The 63-inch-span twin-fin sport jet will accommodate a variety of 60N-class turbine engines and requires no internal ducting, inlet, or tailpipe, leaving the turbine totally accessible. And fully assembled, it easily fits into Rich's Chevy Astro van. Rich comments that a second example is now underway, and after the Tsunami 60 has been flown and tested, he will have a laser-cut parts package and a molded canopy available. **+**

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